Sec. 17
JUL 13 1955

JULY, 1955

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

FOUNDED 1903

Electrodeposition of Nickel from Fluoborate Solutions
Investigation of Suitable Solutions and Optimum Operating Conditions

Bronze Plating: Why and How
Tin-Bronze Deposits Show Important Advantages

The Slot Cell
Description of a Small Scale Plating Test Method

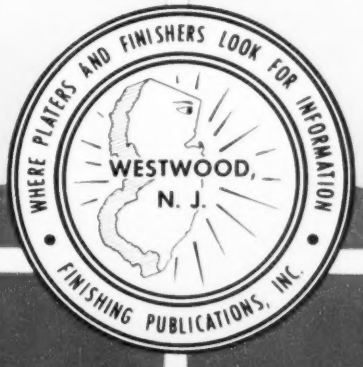
Oil Derrick Marks Chromium Tank
Some Views of One of South California's Largest Hard Chromium Installations

Electroless Chromium
Formula and Operating Details Disclosed for First Time

Science for Electroplaters
Transmutation

Complete Contents Page 41

THE LIBRARY OF CONGRESS
SERIAL RECORD
JUL 14 1955
Copy



READ & PASS ON

_____

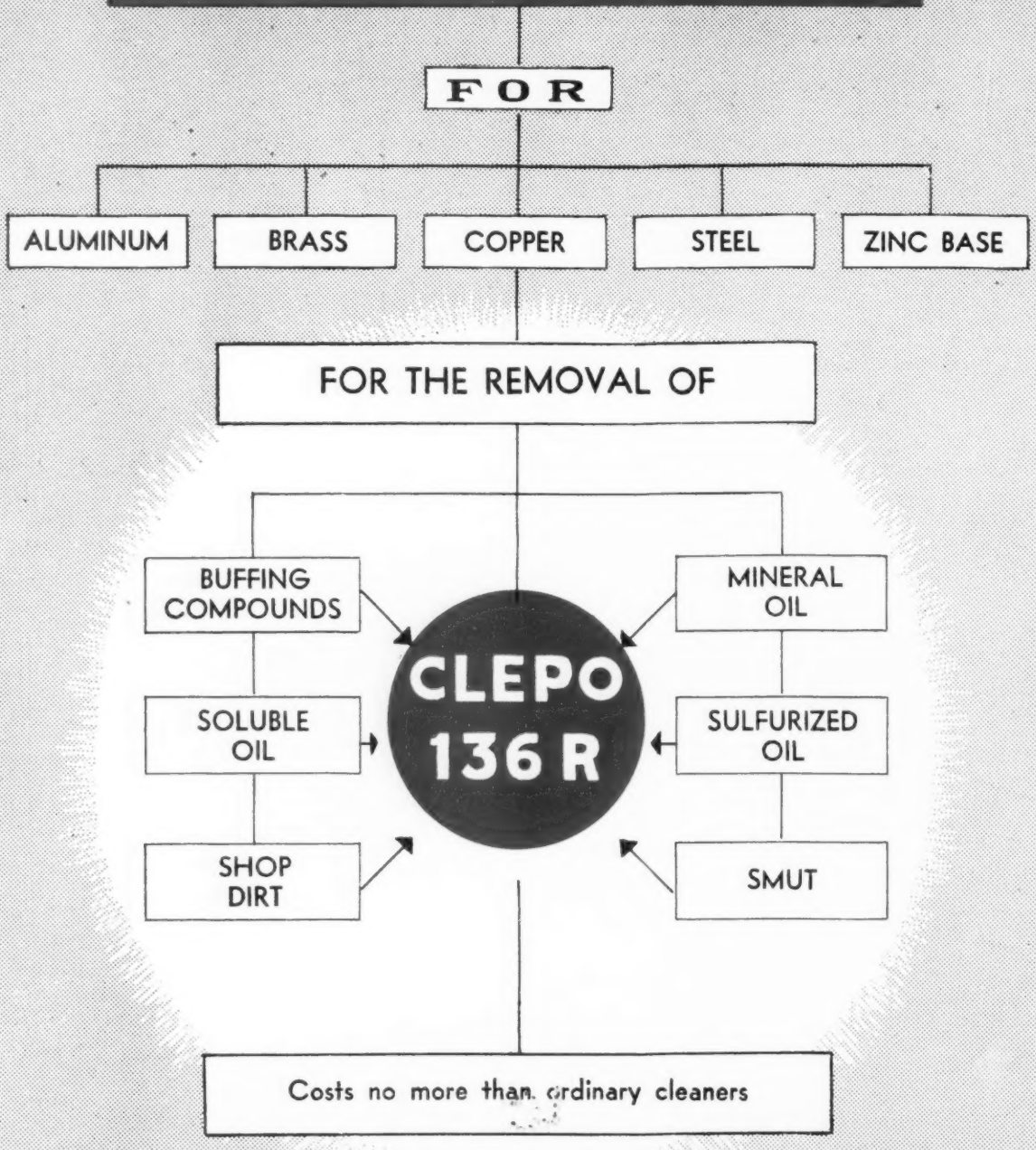
_____

_____

_____

_____

THE HIGH EFFICIENCY SOAK CLEANER



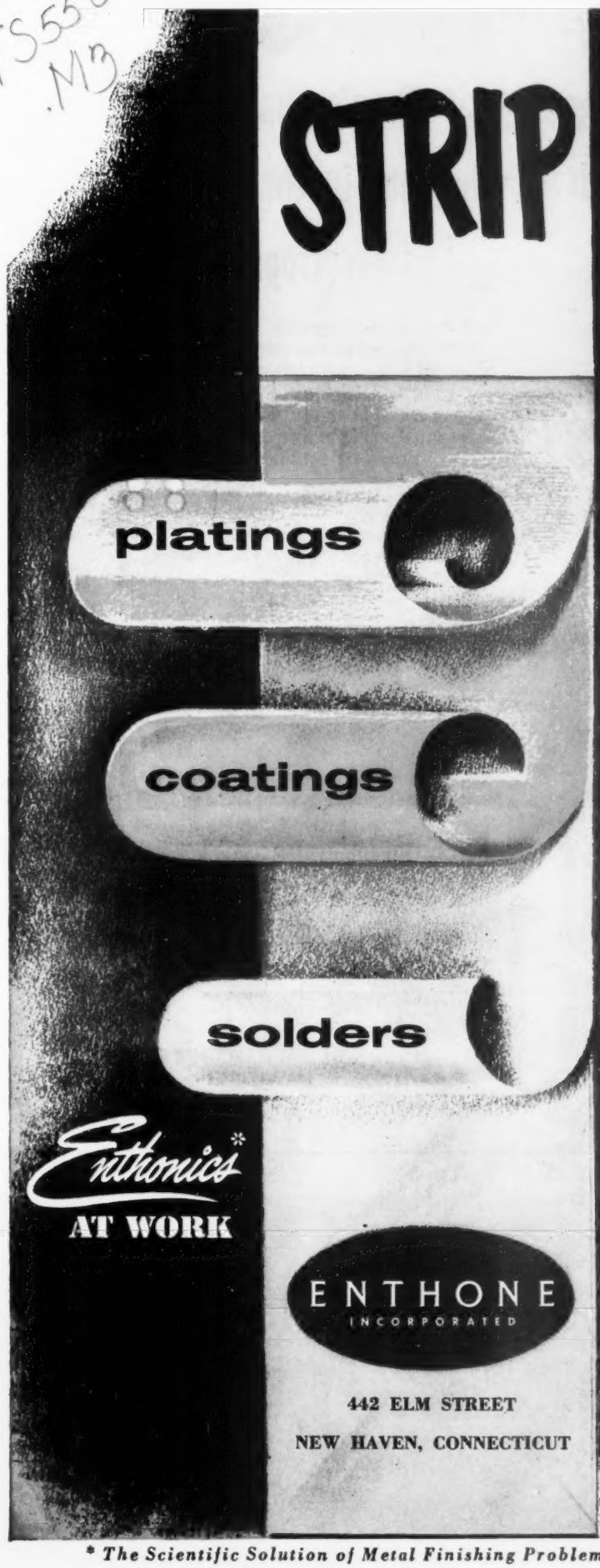
Your CLEPO Service man will be glad to demonstrate this Remarkably versatile cleaner and other CLEPO compounds.

FREDERICK GUMM Chemical Company Inc.

538 FOREST STREET, KEARNY, N.J.

JUL 13 1955

TS550
.M3



. . . economically
. . . quickly
with
ENTHONE
metal strippers

ENTHONE has developed **8** outstanding metal strippers which, without attacking your base metal in any way, quickly and economically strip off defective plated coatings, excess solder, silver brazing metal, and metal smuts.

Where your base metal is . .	and you want to strip nickel, copper, silver, zinc or cadmium chemically, use **ENSTRIP "S",** an additive for sodium cyanide solutions, or . . . **ENSTRIP "A",** which is a prepared compound containing sodium cyanide.
STEEL	where you want to remove copper or nickel coatings electrolytically, use **ENSTRIP 103,** an economical alkaline electrolytic stripper containing no cyanide.
COPPER or STEEL	and you wish to dissolve tin, lead, or tin-lead coatings chemically, use **ENSTRIP "TL",** a fast acting, alkaline stripper.
ALUMINUM, COPPER or STEEL	and you want to take off heavy chromium coatings chemically, use **ENSTRIP "CR-5",** a rapid, acid type stripper.
COPPER ALLOYS	use **ENSTRIP "165-S",** an additive for acid solutions that will give you quick removal of nickel, tin, zinc, lead or cadmium.
ZINC DIE CASTINGS	use **ENSTRIP "L-88",** an acid electrolytic stripper for removing chromium, nickel or copper coatings.

Write directly to Enthone Incorporated, or to your nearest Enthone Service Representative, for further information.

ARDCO, INC.,
5000 West 73rd Street,
Chicago 38, Illinois

R. O. HULL & COMPANY,
1300 Parsons Court,
Rocky River, Ohio

L. H. BUTCHER COMPANY,
3628 East Olympic Boulevard,
Los Angeles, California

** The Scientific Solution of Metal Finishing Problems*

Here's the best shortcut in the field of organic finishing

One operation usually removes paint, rust and oil at the same time.

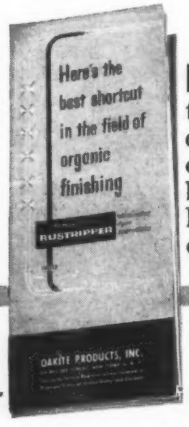
One tank of Oakite Rustripper frequently does all these jobs: (1) strip rejects and conveyor hooks; (2) pickle rusted stock; (3) prepare reconditioned products for refinishing operations.

One tank may eliminate many tanks used in ordinary cycles.

STRIP → RINSE → PICKLE → RINSE → NEUTRALIZE → RINSE

OAKITE RUSTRIPPER

RINSE → PREPAINT → DRY → PAINT



FREE Our illustrated booklet tells how this amazing cleaner - stripper - deruster offers tremendous possibilities for saving minutes, hours, dimes, dollars. Write or send coupon for your copy.

Here's the best shortcut in the field of electroplating

One operation usually removes rust and oil at the same time. One alkaline tank may remove oxides, drawing compound residues and other stubborn soils . . . even strip zinc and cadmium from rejects and racks.

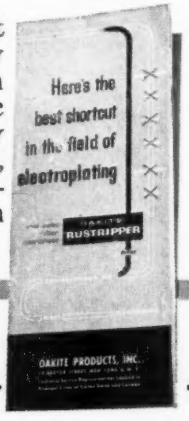
Sensational Oakite Rustripper frequently eliminates acid pickling and its troublesome after-effects: (1) hydrogen embrittlement; and (2) smut that must be removed by electrocleaning or hand brushing.

ALKALINE CLEAN → RINSE → PICKLE → RINSE → ELECTROCLEAN → RINSE

OAKITE RUSTRIPPER

RINSE ← CYANIDE or ACID DIP ← RINSE ← ELECTROPLATE

FREE Our illustrated booklet tells how this shortcut may save you time and money—in tank lines, in automatic platers, in barrel lines—by saving equipment, floor space, acids, water, steam and electricity. Write or send coupon for your copy.



Technical Service Representatives in Principal Cities of U. S. and Canada

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS · METHODS · SERVICE
SCIENCE

OAKITE PRODUCTS, INC.
18 Rector St., New York 6, N. Y.

Send me a free copy of the booklet checked:

☐ *"Here's the best shortcut in the field of organic finishing"*
☐ *"Here's the best shortcut in the field of electroplating"*

NAME_____

COMPANY_____

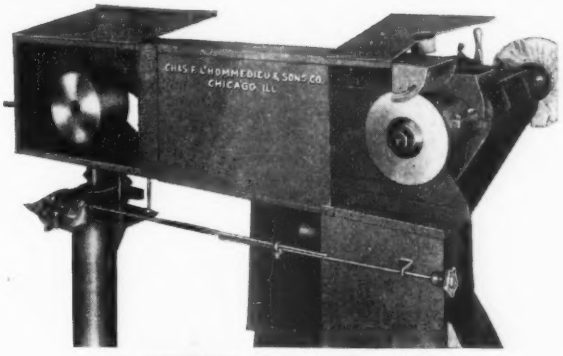
ADDRESS_____

Metal Finishing is published monthly by the Finishing Publications, Inc., 381 Broadway, Westwood, New Jersey, U.S.A.
Entered as second class matter at the Post Office in Westwood, N. J. Volume 53, No. 7, July, 1955. Four Dollars Per Year.

USE "RELIANCE" PRODUCTS FOR

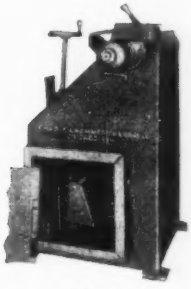
ECONOMY : EFFICIENCY : DEPENDABILITY

WRITE FOR FURTHER DETAILS



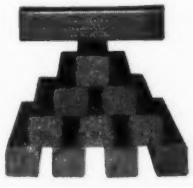
BACKSTAND IDLER WITH LATHE

OBLIQUE
TUMBLING BARREL



#23A
POLISHING LATHE

BACKSTAND IDLER



EXTRUDED COMPOSITIONS
STANDARD SIZE
2 x 2 x 10"

NUWAY BUFFS FOR
FAST CUTTING

Chas. F. L'Hommedieu & Sons Co.

MANUFACTURERS of

Plating and Polishing Machinery

Complete Plating Plants Installed

C. B. Little
Newark, N. J.
W. R. Shields
Detroit, Mich.
Powell Calvert
104 Second Street
Feasterville, Pa.

Gen. Office and Factory:
4521 Ogden Ave.
CHICAGO

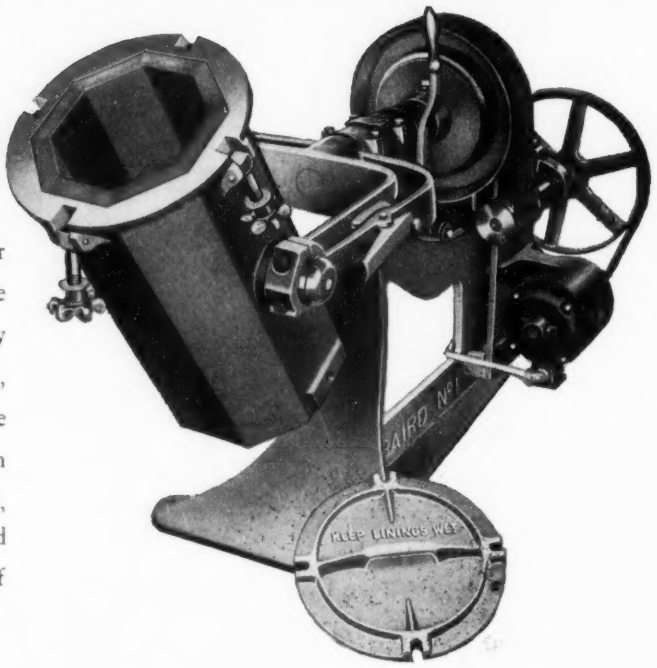
Branches:
Cleveland
and
Los Angeles

ASK **BAIRD** ABOUT IT!

TUMBLING BARRELS FOR MORE THAN 50 YEARS

There's a BARREL in the BAIRD LINE to suit your *Specific Job*

Defense production not only calls for a greatly increased number of barrels, but also for a wide variety of types. The Baird line of Tumbling Equipment and Barrels includes practically every type required for Burnishing, Degreasing, Deburring, Drying, Heating, Japanning, Cleaning and Coating. Barrel shapes are round, bottle-shaped, octagonal, polygonal . . . closed or open mouth . . . cast iron, fabricated steel, sheet brass, Monel, Everdur, stainless steel or wood . . . and metal barrels may be lined with wood, rubber, etc., also with inner shell for introduction of live steam.



Baird manufacture of Tumbling Equipment covers well over a half century . . . and a wealth of experience . . . from the days of belt drive to modern direct motor with an added motor for automatic tilting, if desired.

We illustrate two types . . . (above) No. 1 Baird Single Ball Burnishing Machine, motor drive with tilting, rolling, lined barrel . . . (left) Baird Model D Single Oblique Tilting Tumbler, motor driven. Manual tilting, polygonal, round corner bottom sheet metal barrel. Automatic tilting, if desired.

If you have a finishing problem, send for bulletins. Ask Baird about the best method for your specific job.

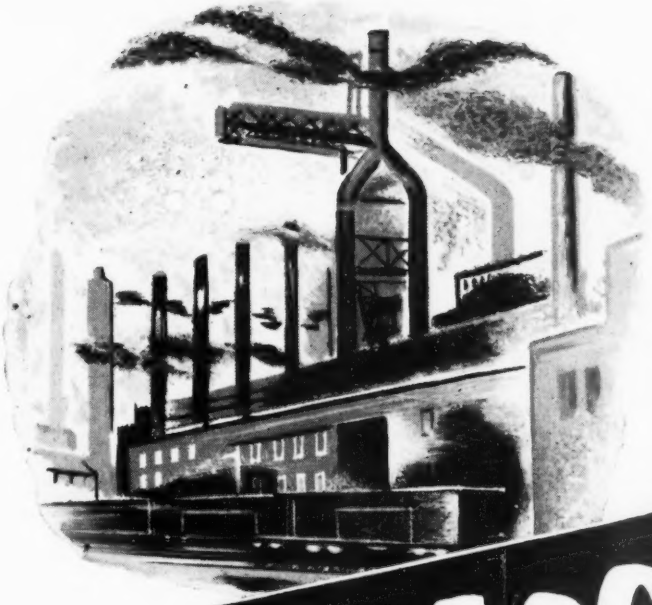
WRITE DEPT. MF.

the **BAIRD MACHINE COMPANY**
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

BBA52

NEW PERFORMANCE ECONOMY CONVENIENCE



the unexcelled solvent for ALL vapor degreasing

Since 1880
75th Anniversary

BLACOSOLV®
DEGREASING SOLVENT
Proved in the field with Dramatic Results

Blacosolv is the superior degreasing solvent that resists all of the elements that contribute to normal solvent breakdown—It is most easily redistilled without disrupting its high stability. Blacosolv is safe —formulated for cleaning aluminum, new alloys and combinations of all metals.

The only solvent with 22 years of "Know How" through a single manufacturing source.

Local Warehouse Stocks From Coast to Coast

Write for complete information about this amazing solvent

G. S. BLAKESLEE & CO. 1844 S. Laramie Ave., Chicago 50, Ill.
NEW YORK • LOS ANGELES • TORONTO

Saving Nickel

Lea Copper-Glo

Superior for Bright High Speed Copper Plating

...Production Proved

The Lea-Ronal Bright Copper Process* is the answer to the plater's prayers, particularly when nickel is still short in supply. Lea Copper-Glo, used with this process, makes it practicable to chrome plate prefinished steel and die-castings over thinner layers of nickel than needed with other processes. With this copper plating you can cut your bright nickel deposit to a minimum because the nickel does not have to be used to build 'brightness.' The copper deposit obtained from the Lea-Ronal Process is brilliant in itself. Thus, you will save by being able to use heavier copper and lighter nickel.

The user of Lea-Ronal Bright Copper Process enjoys numerous advantages, as for example:

OPERATING

- **Brilliant ductile deposits**
- **High current density with 100% efficiency**
- **Exceptional throwing power**
- **Operations with or without free-rinsing wetting agents depending upon specific production conditions**
- **Direct, interrupted, or periodic reverse current**

COST SAVINGS

- **High speed operations reduce tank plating time (Hull cell bright current density range 0 to 60 amp/ft.^{2})**
- **Reduces rejects whether followed by bright nickel plate or otherwise**
- **Reduces consumption of copper cyanide because of excellent anode corrosion**

The Lea-Ronal Bright Copper Process, using Lea Copper-Glo, can be fitted into your plant operating cycle. Most cyanide copper baths can be converted to obtain these advantages.

**Patents Pending*

Distributors for New York and New Jersey Territories

LEA CLEANING COMPOUNDS

FREDERICK **GUMM** *Chemical Company Inc.*

538 FOREST STREET, KEARNY, N. J.

The Power Supply of Tomorrow—Here Today

RAPID GERMANIUM RECTIFIERS

EFFICIENT • COMPACT • SEALED JUNCTIONS • LONG LIVED

The features of new Rapid GERMANIUM Rectifiers are proving to be the answer to many of the plating industry's power problems. More than any other DC power supply, Rapid GERMANIUM Rectifiers answer the need for —

EFFICIENCY — 95% at full load

VOLTAGE STABILIZATION — ±1 volt from no load to full load

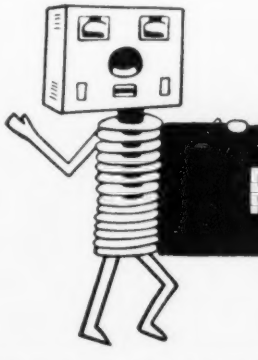
COMPACTNESS — require much less space than conventional units

SEALED JUNCTIONS — corrosion is kept out

PRECISE CONTROLS — oil immersed, fully motorized Inductrol controls, provide continuously variable control at the touch of a button

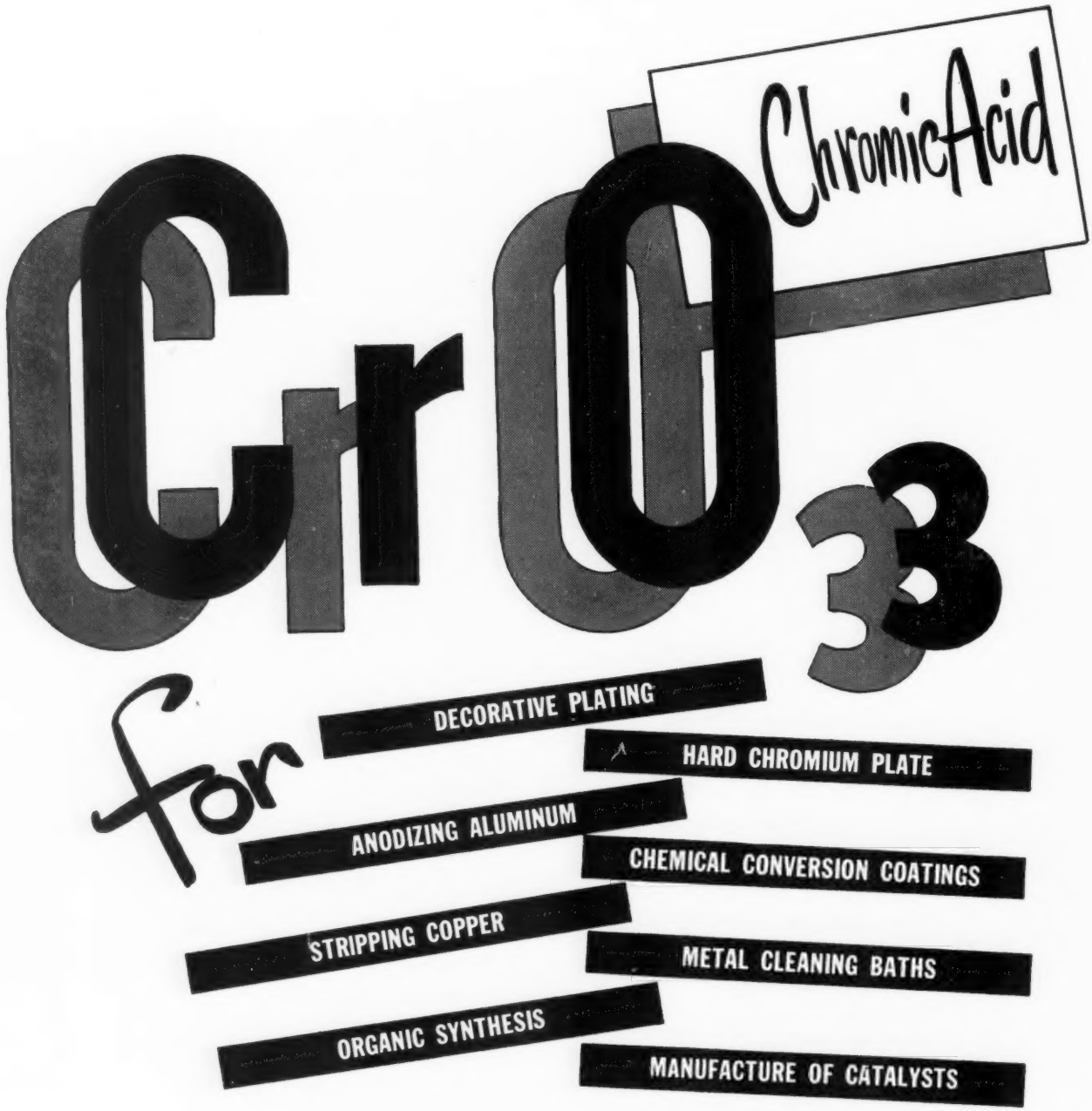
LONG-LIFE — no aging or change in characteristics even after accelerated full load tests

Find out more about RAPID GERMANIUM RECTIFIERS, "the power supplies of tomorrow — here today". Write to Rapid Electric Co., 2881 Middletown Road, New York 61, New York. Ask for Bulletin G-5.



THE NAME THAT MEANS *"More Power to You!"*

RAPID ELECTRIC COMPANY



Chromic Acid production in commercial quantities followed the development in 1926 of a practical process for chromium plating. Originally employed almost entirely for that purpose, Chromic Acid's use has not only expanded in the metal industry but has also proved valuable in many chemical reactions unrelated to plating or metal surface cleaning.

Mutual is keeping abreast of these expanded applications and today supplies a technical grade of Chromic Acid, assaying at 99.75% or better, to an ever-widening list of customers.

Chromic Acid is but one of the chemicals of chromium made by Mutual, specialists in their production for over 100 years. Other Mutual products include Sodium Bichromate, Sodium Chromate, Potassium Bichromate, and Ammonium Bichromate.

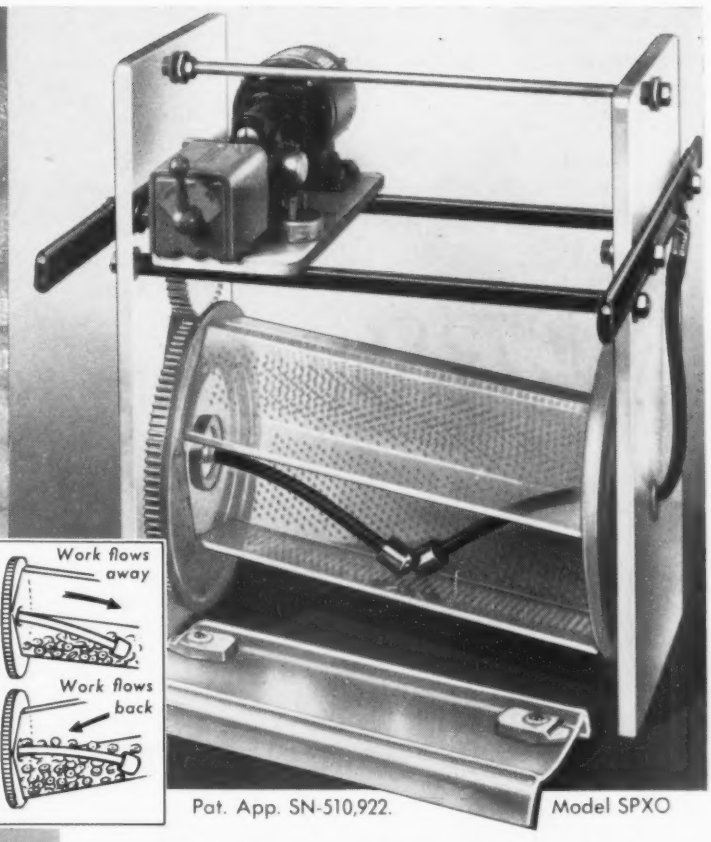
MUTUAL CHEMICAL DIVISION

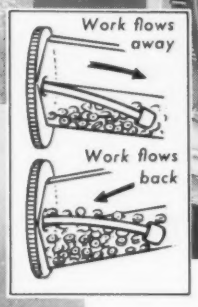
MUTUAL — ALLIED CHEMICAL & DYE CORPORATION

99 PARK AVENUE • NEW YORK 16, N. Y.

Allied Chemical

Startling BREATH-TAKING REVOLUTIONARY





Pat. App. SN-510,922.

Model SPXO

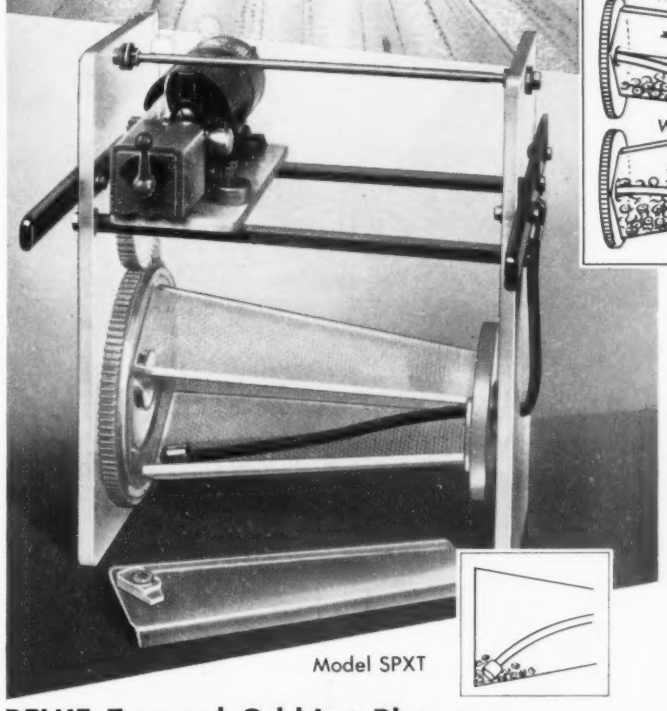
BELKE Double Oscillating Cylinder

Affords uniformity of deposit never before obtainable in barrel plating.

Eccentrically mounted cylinder oscillates as it rotates. Moves the work back and forth *across* the cylinder. No parts remain shielded by cylinder ends. All parts exposed for plating so uniform you can deposit specified thickness in a fraction of the time formerly required.

A tremendous money saver for all barrel plating. An absolute must for washers and flat pieces that tend to stick together.

All sizes from 14 x 30 regulars to 6 x 12 portables.



Model SPXT

BELKE Tapered Odd-Lot Plater

Plates from a few pieces to full capacity

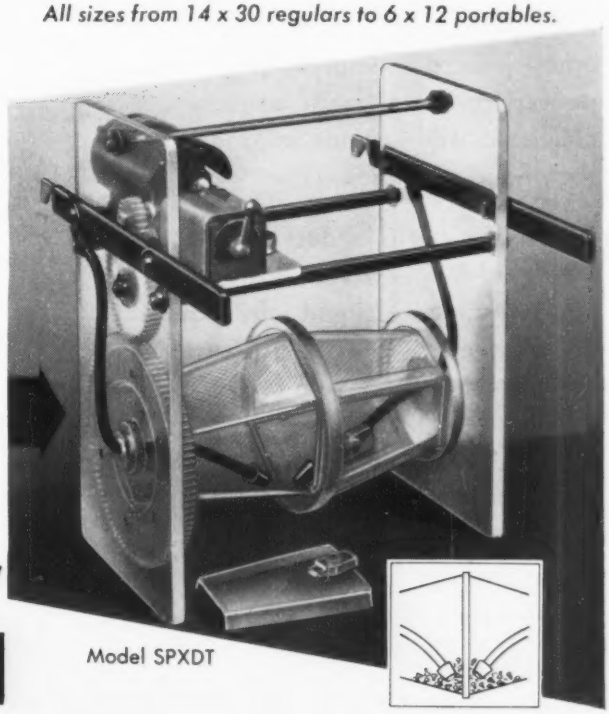
Eliminates costly hand wiring *heretofore unavoidable in plating small quantities.*

Tapered Lucite cylinder *piles the work at the deep end around the ball contact.* Assures uniform plating of any quantity from a few pieces to a full load.

BELKE Double Tapered Odd-Lot Plater

Plates odd lots of two kinds of work.

Double tapered, two-compartment Lucite cylinder piles each kind of work around a ball contact. *Assures uniform plating in each compartment of any quantity from a few pieces to a full load.*



Model SPXDT

Belke Manufacturing Company
947 N. Cicero Ave., Chicago 51

EVERYTHING FOR PLATING PLANTS

VERSATILITY

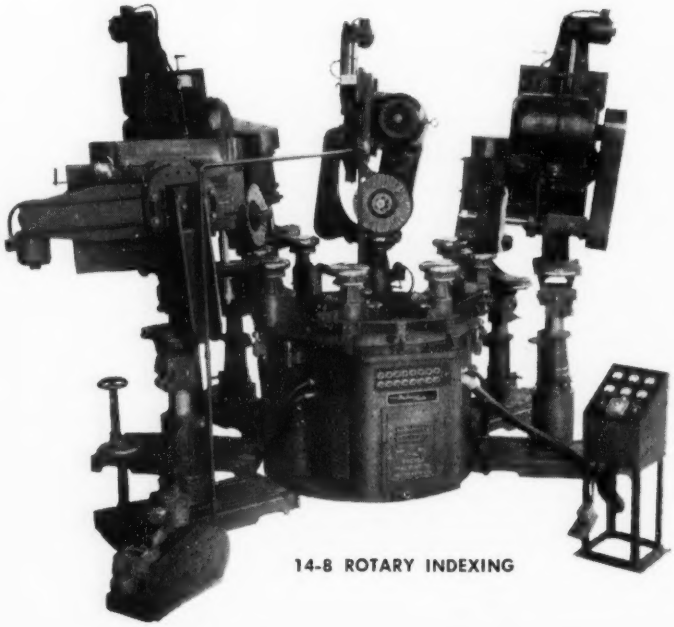
Packer-Matic's ability to handle multiple contour units in short runs is just one of the many sound reasons why cost conscious production men are selecting Packer Automatic Machines to solve their finishing problems.

The Unicycle pictured above depicts versatility in its own right. The Packer-Matic shown below is a perfect example of a modern piece of machinery designed to do many jobs; polishing, buffing or deburring, faster, more economically and with greater uniformity than hand operation.

Packer-Matics are leaders because they are designed specifically to perform a multiplicity of jobs with an efficiency that will increase customer satisfaction and profit.

Send your specifications today to ENGINEERING, for quotation.

THE PACKER MACHINE CO.
MERIDEN, CONNECTICUT



14-8 ROTARY INDEXING

PACKER-MATIC

AUTOMATIC MACHINES FOR BUFFING • POLISHING • DEBURRING

McGEAN BRIGHT NICKEL

Dependable • Easier to Maintain • Versatile

features

Simple control:

Complete methods are available for "on the job" analyses of each bath constituent. Liquid addition agents are easily added to the bath.

Less bath maintenance:

Exceptional tolerance to metallic and organic impurities results in less frequent bath purification treatments.

Wider plating range:

Extreme flexibility allows successful operation over wide ranges of solution composition and plating conditions.

Easier chrome plating:

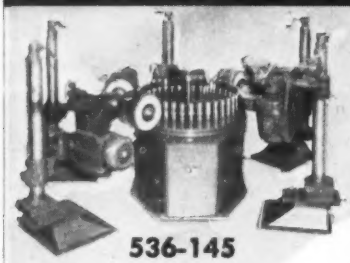
Active nickel deposits provide surfaces which readily accept chromium plating.

The McGean Chemical Company—1040 Midland Building—Cleveland 15, Ohio

dependable manufacturer of anodes and electroplating chemicals

McGEAN

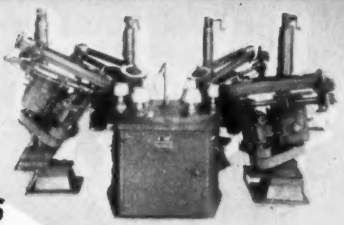
ACME *Rotary Automatics*



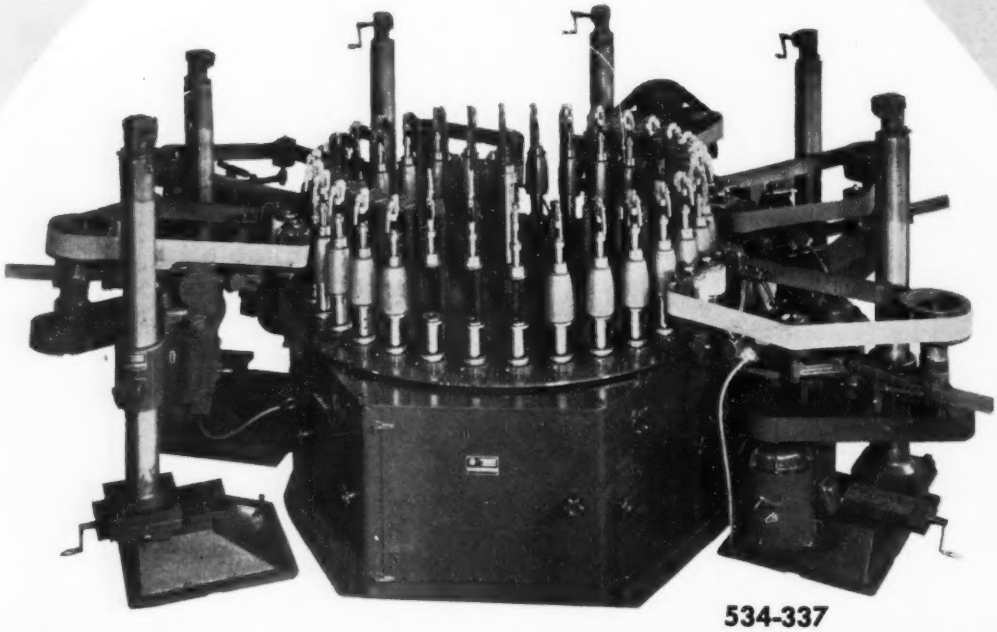
536-145

. . . cut costs on production finishing

ROTARY TABLES ARE AVAILABLE IN SIZES UP TO 24 FT. DIAMETER



512-9-2

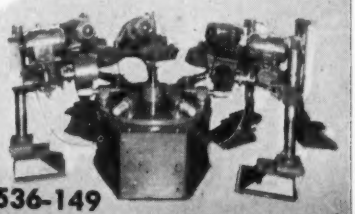


534-337

ACME 8 FT. *Combination Type* ROTARY AUTOMATIC

● This machine can be readily changed from a 32 spindle continuous rotary automatic to an 8 station indexing rotary automatic by simple hand crank adjustment. Various types of ACME adjustable floating head polishing and buffing lathes are used including belt arm attachments on buffing heads, utilizing the same heads for buffing or belt operations. Spindle arrangements are available in multiples of 8.

Rotary Catalog on Request.



536-149

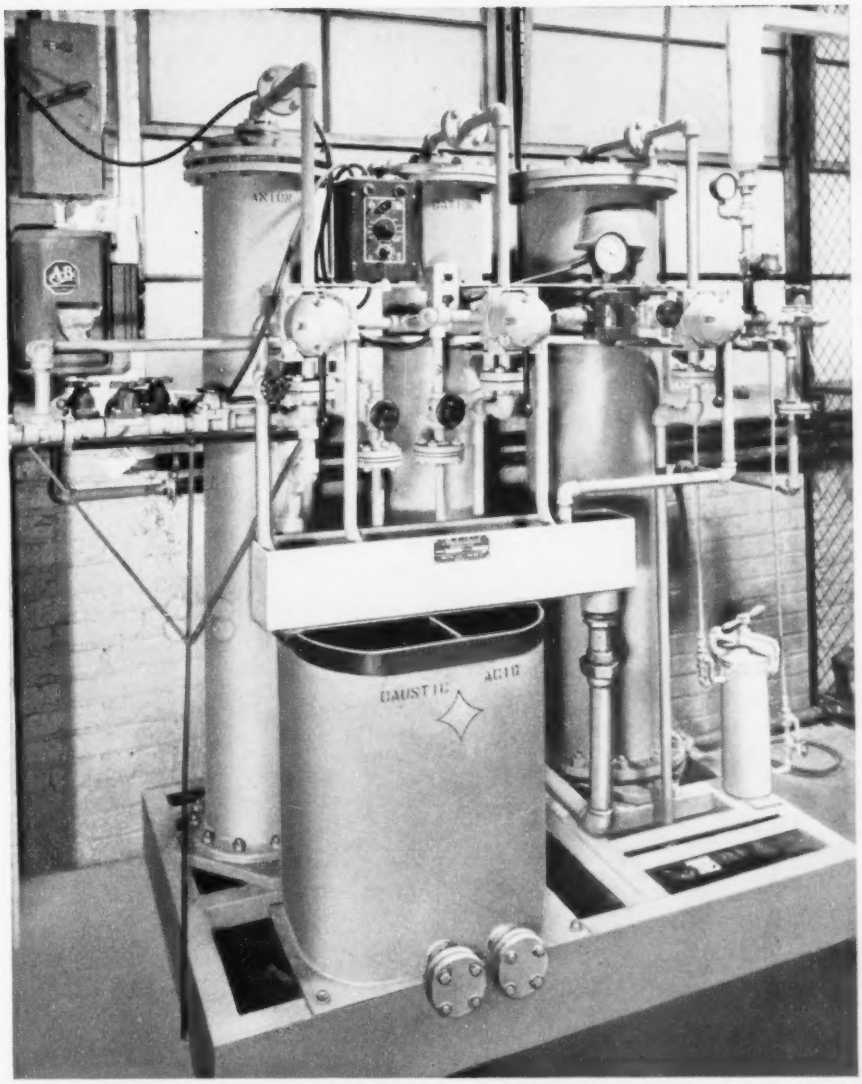
RECOMMENDATIONS and QUOTATIONS . . . will be offered on receipt of blue prints or preferably finished and unfinished parts you contemplate finishing, together with details of your present finishing operations and production requirements.

SPECIAL MACHINERY — AUTOMATIC BUFFING MACHINES

ACME *Manufacturing Co.*

1400 E. 9 MILE RD., DETROIT 20 (Ferndale) MICH.

Builders OF AUTOMATIC POLISHING AND BUFFING MACHINES FOR NEARLY HALF A CENTURY



treating plating rinse wastes at

Sunbeam CORPORATION

CHICAGO 50, ILLINOIS

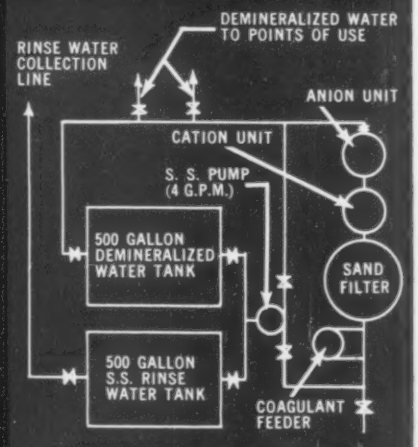
INDUSTRIAL waste treating unit consisting of rubber-lined sand filter with coagulant feeder, cation and anion exchangers complete with pumps, used for treating plating rinse water to remove gold and nickel salts, remove sulfuric and boric acids and return demineralized water to the recirculating system.

Industrial tailored treating units pay for themselves

INDUSTRIAL units for the treatment of metal finishing wastes are used for the recovery of precious metals and for supplying demineralized water for stainless rinsing. The value of the recovered metals, reuse of demineralized water in the recirculating system, and the elimination of troublesome contaminants all add up to pay for the installation, frequently within a matter of months.

Complete INDUSTRIAL Systems are individually engineered and built to meet specific waste treatment problems. Write for full particulars and recommendations.

5453



Flow diagram of the INDUSTRIAL System for the demineralization of recirculated rinse water.

INDUSTRIAL FILTER & PUMP MFG. CO.

5906 OGDEN AVENUE • CHICAGO 50, ILLINOIS

PRESSURE FILTERS
ION EXCHANGERS
RUBBER LININGS
HEAT EXCHANGERS
CENTRIFUGAL PUMPS

SINGLE-KNOB CONTROL provides easy finger-tip setting adjustments.

GENERAL ELECTRIC ANNOUNCES

NEW Germanium Plater That Will Save You Money in Your Plating Operation

Now General Electric brings over four years of germanium experience into the plating field with a new 1000-amp plater that will make possible big savings in your plating operation. Designer and builder of more germanium units than all its competitors combined, G.E. offers you "XB"—experience bonus—along with economy of operation.

YOU SAVE MONEY in installation, operating, and maintenance costs with these new G-E germanium rectifier plating power supplies.

Installation costs are lower, because these compact, lightweight rectifier units need no special foundations.

Operating costs are greatly reduced by germanium's high over-all conversion efficiency*—90 per cent even at 12 volts d-c.

Extremely low maintenance costs in germanium platers result from a minimum of moving parts, and an absence of aging in the germanium element.

NEW G-E GERMANIUM PLATING POWER SUPPLIES feature down-draft air cooling, single-knob finger-tip control, and complete control flexibility. In addition, these 1000-amp, 12-volt units have smooth, stepless control, and hermetically sealed rectifier cells for long life in corrosive plating room environment.

G.E.'s down-draft air cooling draws air in horizontally through the front panel minimizing dust and dirt intake.

Single-knob finger-tip control means not only simplified adjustment, but elimination of multi-knob fumbling and possible transformer unbalance, as well.

Complete control flexibility permits the addition of automatic control in the future without necessitating complete replacement of the manual control.

To date, over 5990 kilowatts of G-E germanium rectifier power supplies are in operation—the equivalent of 1,000,000 amperes at six volts, the normal plating voltage—with another 5080 kilowatts on order. G.E. offers you real germanium know-how based on experience.

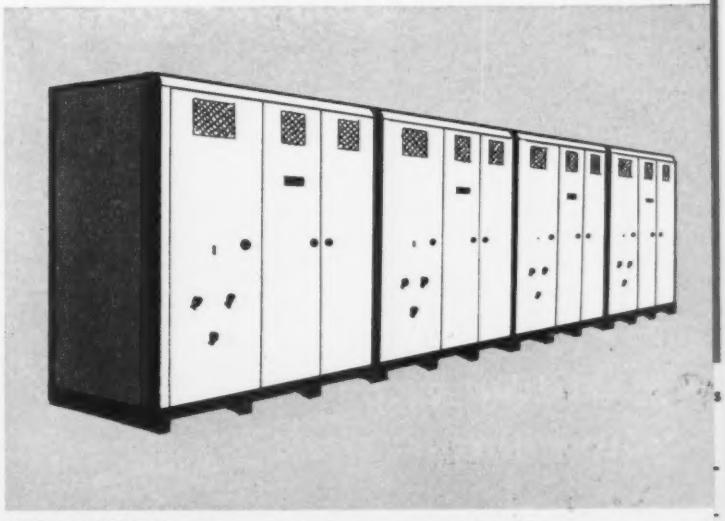
ADDITIONAL INFORMATION on G-E germanium plating power supplies is available from any authorized G-E plating agent, or by writing Section 463-12, General Electric Co., Schenectady 5, N. Y.

*Measured in accordance with recognized ASA, AIEE, and NEMA standards.

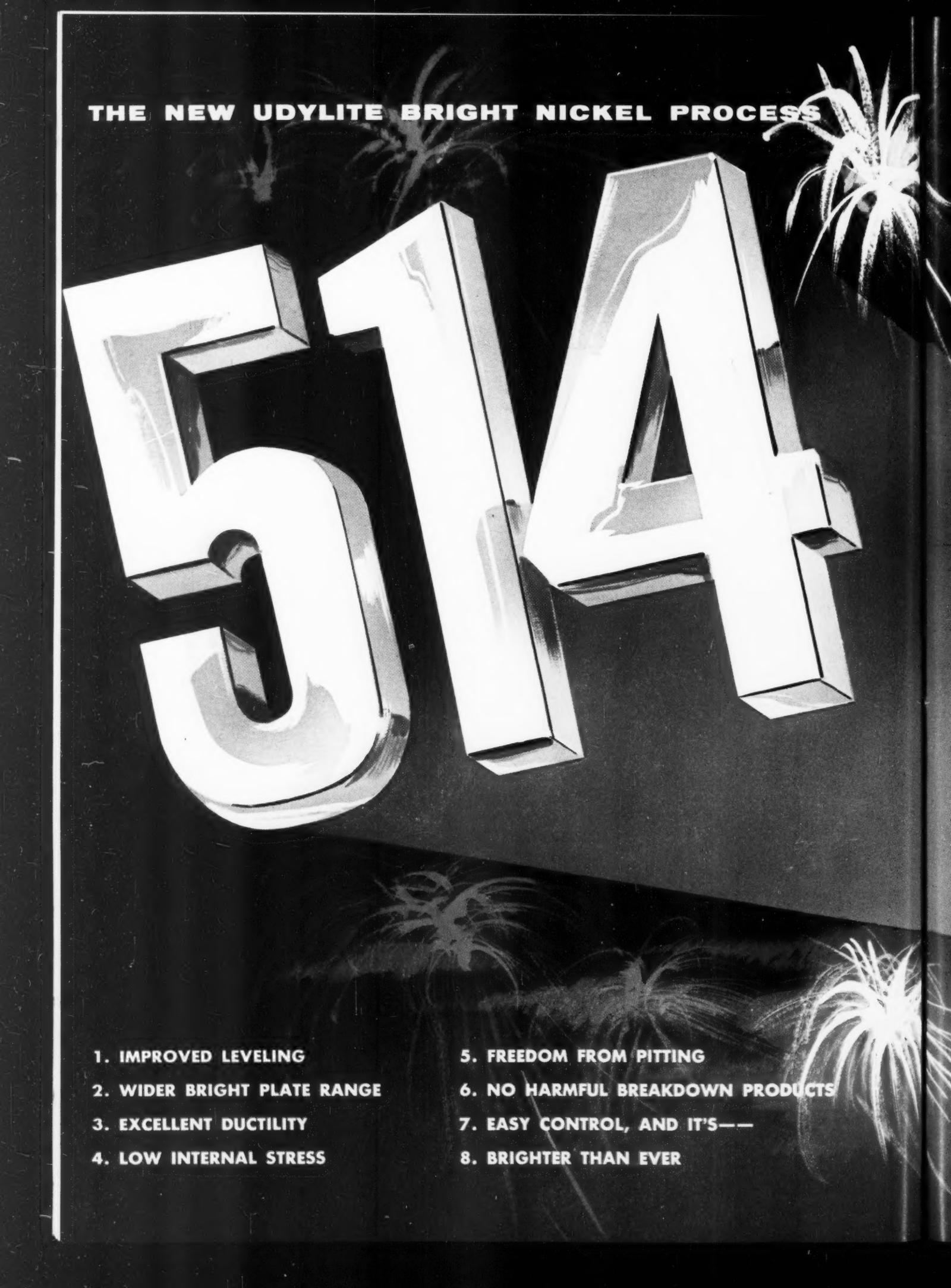
Progress Is Our Most Important Product

GENERAL ELECTRIC

EASE OF INSTALLATION, and the fact that only one side of the rectifier need be clear, helps eliminate layout problems.



"BIG BROTHER" of the new plating power supply, this germanium installation furnishes d-c power for anodizing operations.


THE NEW UDYLITE BRIGHT NICKEL PROCESS
514
1. IMPROVED LEVELING
2. WIDER BRIGHT PLATE RANGE
3. EXCELLENT DUCTILITY
4. LOW INTERNAL STRESS
5. FREEDOM FROM PITTING
6. NO HARMFUL BREAKDOWN PRODUCTS
7. EASY CONTROL, AND IT'S——
8. BRIGHTER THAN EVER

THE
Udylite
CORPORATION

We would like to discuss 514 Bright Nickel Process with your sales representative. Please have him call.

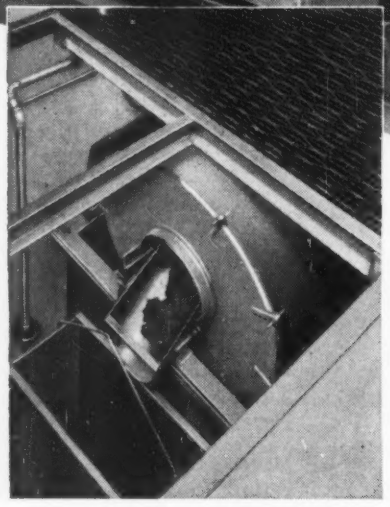
NAME _____

COMPANY _____

STREET _____ ZONE _____

MURRAY WAY

MICRO-POLISH strip grinding boosts output over 600 percent for Michigan manufacturer



The New Murray-Way rotary filter which efficiently reclaims coolant on this operation. Permanent filtering media saves the cost of this equipment in a short time.

- ★ **Assures Product Uniformity**
- ★ **Cuts Material Loss and Scrap**
- ★ **Eliminates Down-time**
- ★ **Replaces Two Expensive Hand Operations**
- ★ **Facilitates Subsequent Operations**
- ★ **Improves Product Appearance**
- ★ **Eliminates Dust and Mess**
- ★ **Pays For Itself**

Here's one more illustration of Murray-Way's ability to do the job better, faster, and more economically.

Murray-Way's Automatic Equipment, thorough experience and expert engineering can save YOU money on YOUR polishing, buffing, grinding or filtering operations. Why not give us a call . . . JOrdan 4-6890 Detroit, or write for our complete, illustrated Micro-Polish Brochure.

MURRAY WAY

MURRAY-WAY CORPORATION

P. O. BOX 180, MAPLE ROAD EAST • BIRMINGHAM, MICH.

Polishing, Buffing, Grinding, Filtering Equipment that automatically cuts your costs.

HARSHAW

Cadmium Fluoborate
Lead Fluoborate
Copper Fluoborate
Tin Fluoborate
Nickel Fluoborate
Fluoboric Acid

Harshaw Fluoborate Plating Chemicals

Select the nearest Harshaw Branch...

CHICAGO 32, 4925 South California Avenue
CINCINNATI 13, 6265 Wiehe Road
CLEVELAND 6, 1945 East 97th Street
DETROIT 28, 9240 Hubbell Avenue
HASTINGS-ON-HUDSON 6, New York
HOUSTON 11, 6622 Supply Row
LOS ANGELES 22, 3237 South Garfield Avenue
PHILADELPHIA 48, Jackson and Swanson Streets
PITTSBURGH 22, 505 Bessemer Building
6th Street & Fort Duquesne Blvd.

THE **HARSHAW CHEMICAL** CO.
1945 East 97th Street, Cleveland 6, Ohio
BRANCHES IN PRINCIPAL CITIES

CLEANING SPECIALISTS

give you a "brighter" outlook on life.

It's amazing how pleasant the view can be after one of these steel-nerved, sure-footed, alert Cleaning Specialists have done their job.

Northwest's Metal Cleaning Specialists are "alert" to your problems when it comes to giving your products a "brighter" outlook. Day in—day out, Northwest carries on the constant search for better, lower cost, analytically-correct cleaners to give you dependable, good looking, permanent finishes.

Remember —YOUR COST PER FINISHED ARTICLE IS THE TRUE COST OF YOUR CLEANER

From Northwest's years of experience in developing job-adjusted cleaners for your specific needs have come such processes as the LO-HI pH—for cleaning prior to plating, painting or vitreous enameling; ALKALUME—for preparing aluminum for finishing and spot welding; INTERLOX—for phosphate coating; SPRA-LUBE—to control over-spray of "today's" paints in water wash paint booths; PAINT STRIPPERS—specific to your needs; SUPER-DRAW & FLUID FILM—for drawing metals.

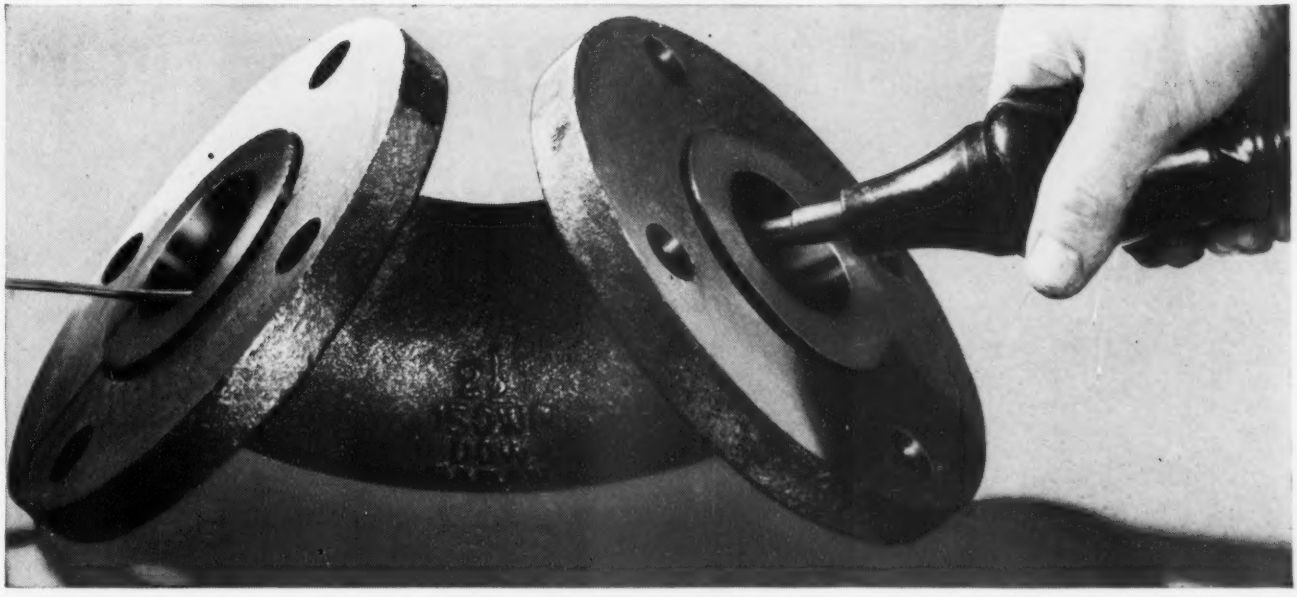
Northwest's production-tested chemicals and "Right-the-first-time" recommendations will save you money. Northwest Service is as close as your phone.

NORTHWEST CHEMICAL CO.

9310 ROSELAWN DETROIT 4, MICH.

pioneers in pH cleaning control *serving you since '32*

DOW



You can see why

SARAN LINED PIPE

KEEPS SHUTDOWNS TO A MINIMUM

It's made of corrosion-resistant saran pipe swaged into strong, rigid, nonbursting steel. And every piece is spark tested before you buy!

Unscheduled shutdowns are a thing of the past when you use saran lined pipe, fittings and valves to convey corrosive liquids. This modern, trouble-free piping is corrosion resistant . . . forms tight, snug, leakproof joints . . . won't burst under *working* pressures up to 150 psi. And every single piece of saran lined pipe is carefully spark tested by hand to be sure that there are no pinpoint holidays or cracks in its lining. Cast steel lined fittings are available for higher pressures.

Installation costs are surprisingly low with saran lined pipes, fittings and valves, too. They can be cut and threaded in the field with standard pipe-fitter's tools. Their rigidity means few supporting members are needed.

If you want to convey acids, alkalies, or other corrosive liquids at low over-all cost, be sure to investigate saran lined pipe. Contact the Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale 20, Michigan, Department SP528C-1.

RELATED SARAN PRODUCTS

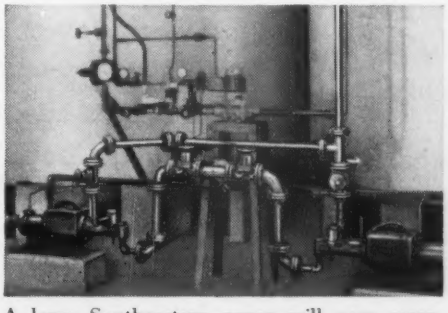
Tank lining • Saran rubber molding stock • Saran tubing and fittings • Saran pipe and fittings.

SOME OF THE MANY INSTALLATIONS USING

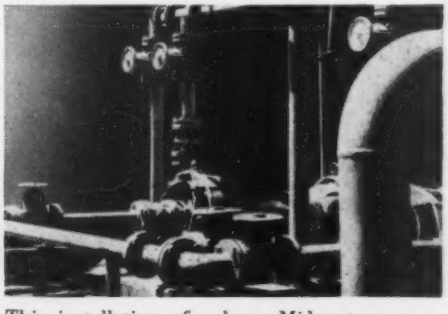
SARAN LINED

STEEL PIPE

Saran Lined Pipe is Manufactured by The Dow Chemical Company Midland, Michigan

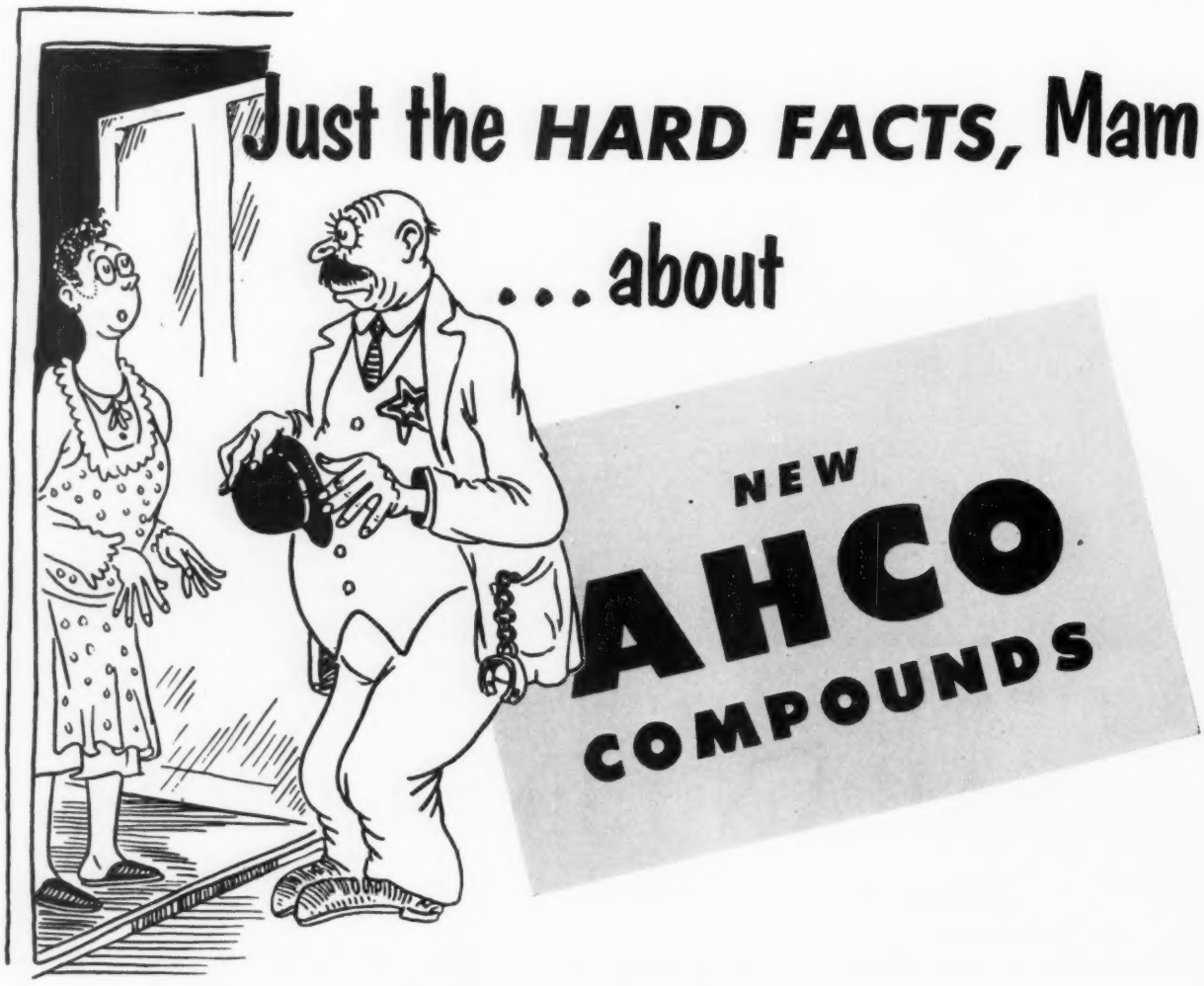


A large Southeastern paper mill uses saran lined pipe to handle corrosive alum solution. It has proved to be an exceptionally satisfactory answer to eliminating unscheduled shutdowns.



This installation of a large Midwest company has conveyed highly corrosive hydrochloric acid for over seven years. The joints have remained as tight and leakproof as new.

you can depend on DOW PLASTICS DOW



for AUTOMATIC BUFFING

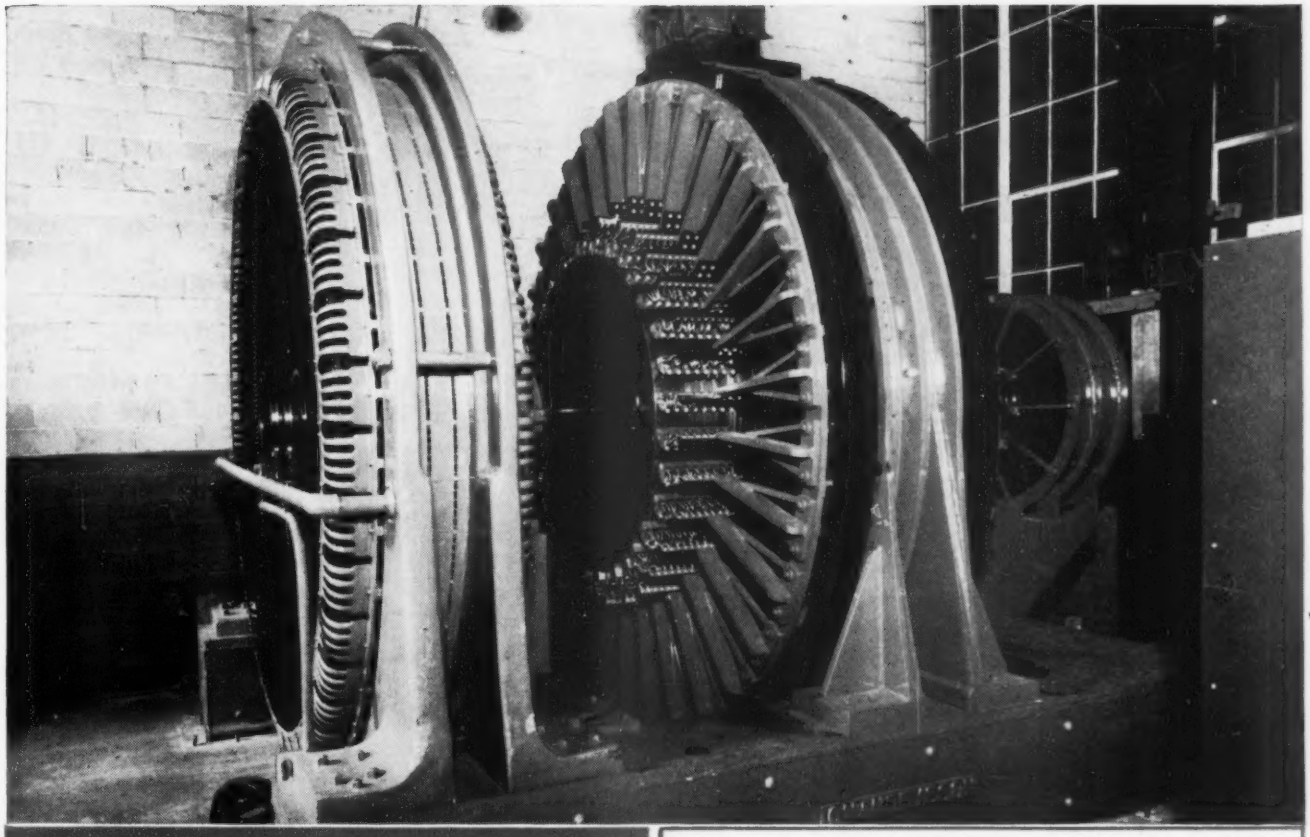
High-speed automatic buffing needs very hard and stable compounds to operate efficiently — hard to withstand tough usage . . . stable to withstand extreme heat. Now Apothecaries Hall Company has formulated a new series of high speed buffing bars that always adhere to the wheel, never lose their abrasive quality.

This new Ahco series includes tripoli bars, white bars, and other compounds for buffing surfaces from plastics to non-ferrous metals, steel, and stainless. There is a wide variety of uniform sizes for all types of machines.

Like all Ahco compounds, these new high-speed bars are manufactured under strict laboratory control to assure outstanding performance. Investigate these latest results of Ahco research NOW.

For full details about Ahco Compounds for automatic buffing, write today to Apothecaries Hall Company, 22 Benedict Street, Waterbury, Connecticut.

Apothecaries Hall Co.



INDUSTRY LEADERS CHOOSE

Chandeysson

ELECTROLYTIC GENERATORS

Example:

Low Cost, Low Voltage Power Conversion at Doehler-Jarvis Division of National Lead Company, Toledo, Ohio.

20,000 ampere Chandeysson Generator recently installed at Doehler-Jarvis Division is just one of several Chandeysson Generators in use by this well-known industrial manufacturer.

For any kind of power conversion application, Chandeysson Generators give you lifetime service, at low cost.

Use Chandeysson GENERATORS

For Low-Voltage Power Supply AND SAVE 4 WAYS

1. **Use Less Power** . . . precision-built for high efficiency and built-in voltage regulation.
2. **Be Sure Of Power When You Need It Most** . . . overload capacity as great as 50% momentarily and 25% sustained, without distress or damage.
3. **Get More Out Of The Power You Pay For** . . . built-in high power factor at no extra cost.
4. **Enjoy Lifetime Power Dividends** . . . sustained, lifetime overall constant efficiency as high as 85% does not decrease with age or overload.

For product information write for bulletins D-101 and D-102—for names of users and installation data ask for bulletin D-104.

CHANDEYSSON ELECTRIC COMPANY • 4074 Bingham Ave., St. Louis 16, Missouri 50A

GLO-QUARTZ*

PROUDLY PRESENTS

TYPE "U" Translucent Fused Quartz

Pat. Pending

ELECTRIC IMMERSION HEATERS

World's FIRST Successful Acid Heater

FIRST Major Improvement in Quartz Immersion Heaters in Over 35 Years

GUARANTEED ONE YEAR

OUTSTANDING FEATURES

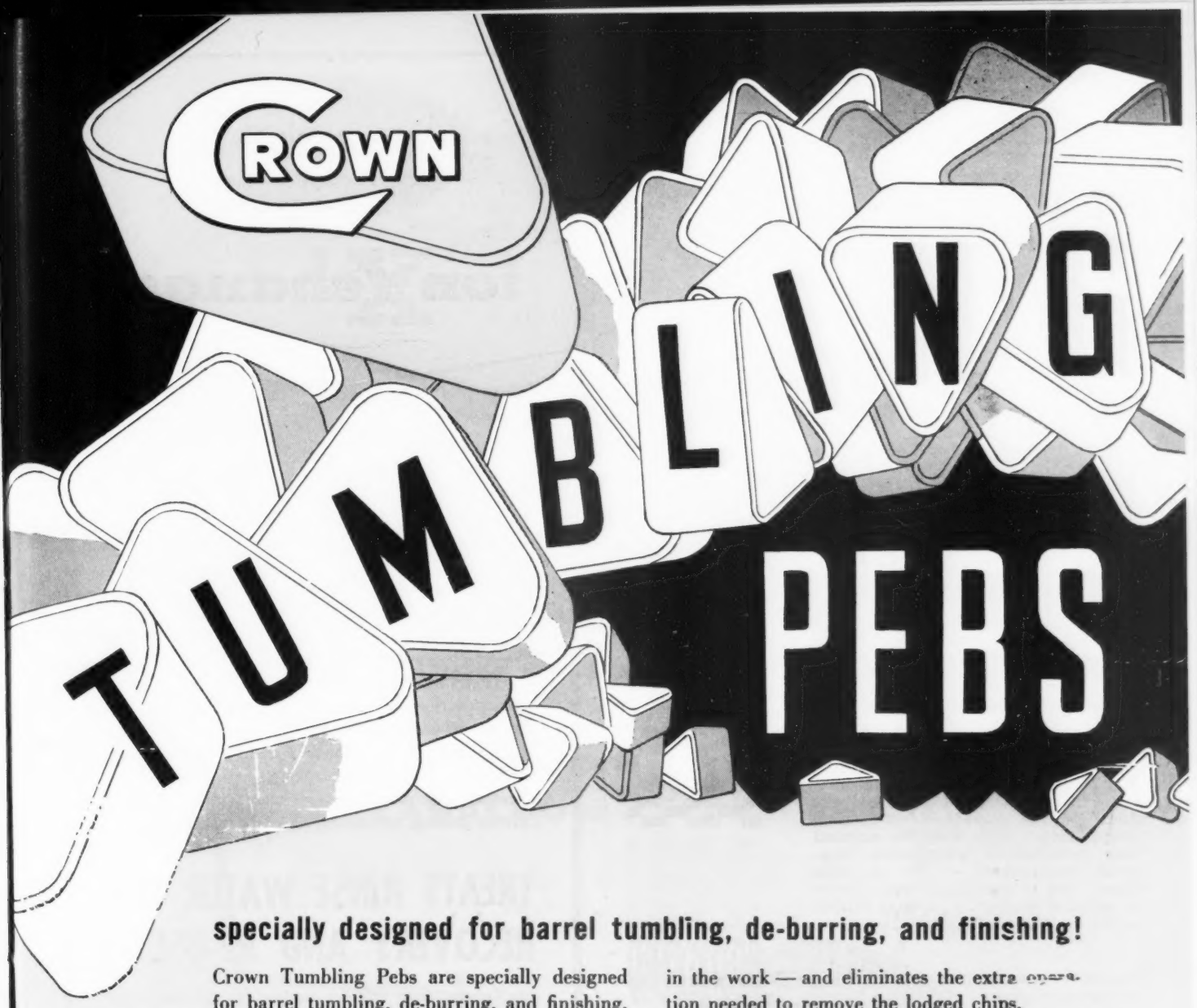
- *Guaranteed To Out-Perform and Out-Last All Other Quartz Heaters*
- *Heats Instantly*
- *100% Short-Proof Construction*
- *100% Mechanical and Thermal Shock-Proof Construction*
- *Increases Plating Quality*
- *No Stray Currents*

WRITE TODAY FOR DETAILS

*Trademark Reg. U. S. Pat. Off.

GLO-QUARTZ ELECTRIC HEATER CO., Inc.

WILLOUGHBY, OHIO



specially designed for barrel tumbling, de-burring, and finishing!

Crown Tumbling Pebs are specially designed for barrel tumbling, de-burring, and finishing. They are manufactured of a tough, white ceramic, uniform in size and shape, and available in a variety of sizes. Crown Pebs have many advantages in tumbling operations and are widely used for de-burring and similar tumbling processes in many types of barrel tumbling equipment.

Eliminates lodging in holes . . . Crown Pebs eliminate the "lodgement" hazard of random shaped chips. Just select the proper size, and the uniform size and shape of the Crown Pebs eliminates lodging in holes, recesses, and slots in the work — and eliminates the extra operation needed to remove the lodged chips.

Longer life . . . The tough wear resistant ceramics in Crown Pebs give a service life several times longer than either natural stones or the aluminum oxide type of tumbling chips.

Crown Tumbling Pebs do not cut as rapidly as random shaped natural stones and aluminum oxide chips, but the uniform results and their much longer life make them very valuable in many tumbling and de-burring operations.

Samples sent on request.

CROWN RHEOSTAT AND SUPPLY COMPANY

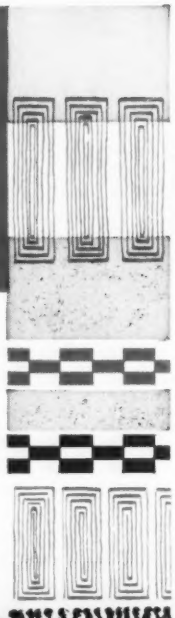
3465 N. KIMBALL AVENUE • CHICAGO 18, ILLINOIS

From MEXICO

... and **JOE-D**

Come the Original

BIAS SISAL BUFFS



- **GUARANTEED FRAYPROOF PERFORMANCE!**

The high-quality sisal used in **every** JOE-D Buff is grown and specially woven for JOE-D in Yucatan, Mexico. Top quality raw material is one reason why JOE-D Sisal Buffs are the finest on the market — fast-cutting, long-lasting. And JOE-D's **original** bias construction guarantees **frayproof** performance — never a loose thread end to scratch or mar. Insist on **original** quality . . . specify JOE-D —you can't buy a better buff!

The JOE-D line covers a complete selection of Bias, Bias Sisal, Bias Spoke (Finger) and Conventional Buffs—as well as quality Polishing Wheels.

Holders of the original patent on Bias Sisal Buffs— U.S. Pat. No. 2642706

ATTENTION JOBBERS!

Some choice territories still available. WRITE TODAY!

the JOE-D Buff Company

SANDWICH, ILLINOIS • TELEPHONE 2171

ILLCO-WAY

ionXchange

SOLVES A PROBLEM OF WASTE DISPOSAL...

The process of ionXchange offers the newest, simplest, and cheapest method of disposing of contaminated and weakened plating solutions. Instead of draining off such "waste" solutions, or treating them chemically where draining is impossible, ionXchange provides (a) recovery of most of the remaining plating acids for use in new make-up, (b) de-ionization of the contaminants so the effluent is clean and non-polluting, and (c) substantial savings in plating costs. *Practical* equipment is now available for treating chrome plating, anodizing, and other solutions.

TREATS RINSE WATER FOR RECOVERY AND RE-USE...

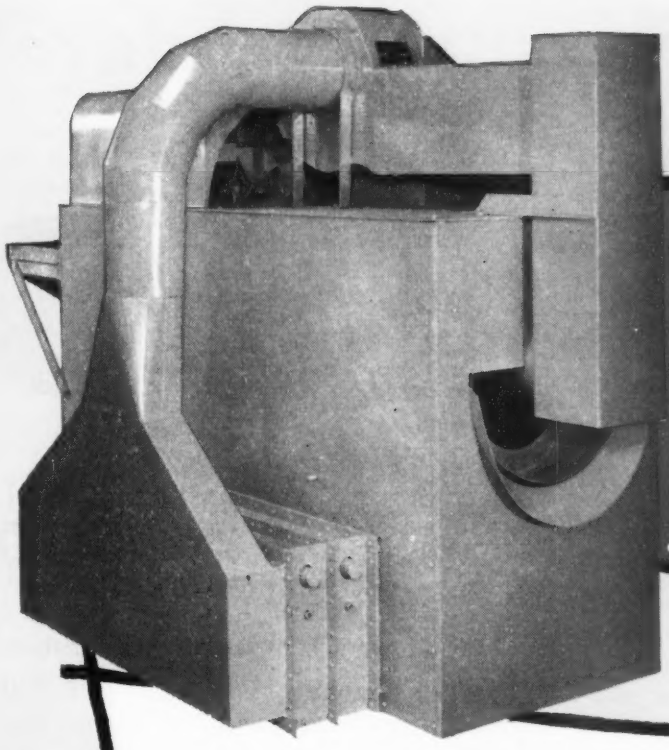
IonXchange also offers a method for treating rinse waters that accomplishes valuable improvements. Instead of running rinse water to drain in large quantities, ionXchange will (a) purify it completely so it can be recycled, (b) recover drag-out plating acids and make them available for new make-up of plating solution, and (c) reduce plating costs to a noticeable degree. Reprints of articles describing these operations, and pictures of successful installations, will be forwarded on request. Our representatives are available to consult on your specific needs.

ILLINOIS WATER TREATMENT CO.

836 CEDAR ST., ROCKFORD, ILLINOIS

ILLCO-WAY ionXchange

NEW YORK OFFICE: 141 E. 49TH ST., NEW YORK 17, N.Y.
CANADIAN DIST. PUMPS & SOFTENERS, LTD. LONDON, ONT.



Bone Dry.. Up To 900 Quarts Of Parts Per Hour ...Automatically!

LASALCO's *New* SPIRAL DRYER

SPECIFICATIONS

SIZE: Length 9' 0", Width 4' 6", Height 8' 0"

DRUM SIZE: 22" Diameter, 72" Long, 9" Screw

DRUM PERFORATIONS: ½" (Other sizes available)

DRYING TIME: (Aver.) 3-5½-9½ minutes

PRODUCTION: 30 to 900 Quarts per hour (40 to 120 cubic feet)

DRIVE: ½ HP 220/440 volt, totally enclosed ball bearing motor, 1200 RPM

DISCHARGE CHUTE: 20" From Floor (minimum)*

LOADING CHUTE: 42" From Floor

HEATER: Steam—Aerofin blast coils with 1 HP fan for recirculation of air. (Also available with gas heat.)

*Can be arranged for any height from tote pan to 55-gal. drum.

- Virtually eliminates *all* drying labor.
- Hot blasts parts completely dry over a 3-speed spiral—automatically—regardless of design, recesses or contours in the work.
- Automatically unloads into barrels or tote pans. Instantly ready for the next load.
- Specially designed heater eliminates all moisture from the air.
- Replaces up to 3 sawdust tumblers plus 2 or 3 centrifugal dryers.
- Can be arranged to take full hopper loads from final hot water rinse without handling.

Write Today For Details On This Time Saver And Money-Maker

LASALCO, INC.

HOME OFFICE
2820 LaSalle St. • St. Louis 4, Mo.
PRospect 1-2990

IN TEXAS
501 West Eighth St. • Irving (Dallas), Tex.
Phone: 3-4921

FOR BETTER CORROSION RESISTANCE

Iolyte TANKS
Fabricated to your Specifications

NO MOLDS NEEDED — Made any size, any shape, at no extra cost and no loss of delivery time.
UNIFORM DIMENSIONS — NO TAPERING — Dimensions are same at bottom and top . . . means larger capacities than tapered molded tanks.
FLANGES, DAMS, Etc. — Can be inexpensively equipped with flanged connection, holes, overflow dams, baffles, separations, etc.
CHEMICALLY RESISTANT THROUGHOUT — Fabricated from *Iolyte* sheet properly reinforced. This is a structural material . . . not a lining.

Write for literature, prices, and table of chemical resistance for Iolyte tanks, crocks, ducts.

Iolyte CROCKS
Available from Stock

PRICE LIST

Gal. Cap.	Outs. Diam.	Outs. Hght.	List Cost	Gal. Cap.	Outs. Diam.	Outs. Hght.	List Cost
5	9"	18"	18.00	14	18"	12"	35.00
5	10"	15"	18.00	20	18"	18"	40.00
8	12"	16"	22.00	26	18"	24"	45.00
10	12"	20"	24.00	30	18"	28"	49.00
12	12"	24"	26.00	40	18"	36"	59.00
9	10"	24"	23.00	50	18"	48"	69.00
7	9"	24"	21.00	27	22"	18"	49.00
10	16"	12"	26.00	30	22"	20"	53.00
12	16"	14"	28.00	55	22"	36"	70.00
15	16"	18"	33.00	73	22"	48"	83.00
20	16"	24"	40.00	55	28"	22"	76.00
30	16"	36"	49.00	95	28"	36"	98.00
40	16"	48"	59.00	125	28"	48"	125.00

Schorithene
Corrosion-Resistant Polyethylene-Lined Drums

PRICE LIST

	Gallon Cap.	Inside Diam.	Inside Height	List Cost
STANDARD	20	18"	20"	24.50
	30	18"	27"	29.50
	55	22"	34"	36.50
SEAMLESS	30	18"	27"	40.00
	50	22"	34"	52.00

Covers $4.00 extra

Order from us or your distributor. Unless rated firm, payment with order. No COD's.
ALL PRICES F.O.B. FACTORY

SCHORI PROCESS DIVISION
FERRO-CO CORPORATION
8-11 43RD ROAD, LONG ISLAND CITY 1, N. Y.
FACTORY: 59-31 54TH STREET, MASPETH, L. I.

A

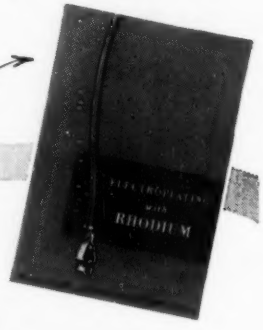
RHODIUM PLATE

Resists Corrosion

The hard, brilliant white finish of Rhodium plate strongly resists corrosion, making it ideal for electrical and electronic applications. This exceptional property assures protection against atmospheric conditions, providing an excellent finish for ultra-high frequency applications. Its hardness and chemical resistance are unmatched for use with reflectors, particularly with the open arc.

Rhodium plate retains its highly reflective surface indefinitely and does not diminish on exposure to corrosive atmosphere. For decorative, industrial and commercial applications, Rhodium plate qualifies as the top finishing material.

For valuable data on other properties and applications of RHODIUM PLATE, write for free detailed booklet.



BAKER & COMPANY, INC. *PRECIOUS METALS*

113 ASTOR STREET, NEWARK 5, N. J.
NEW YORK • SAN FRANCISCO • LOS ANGELES • CHICAGO

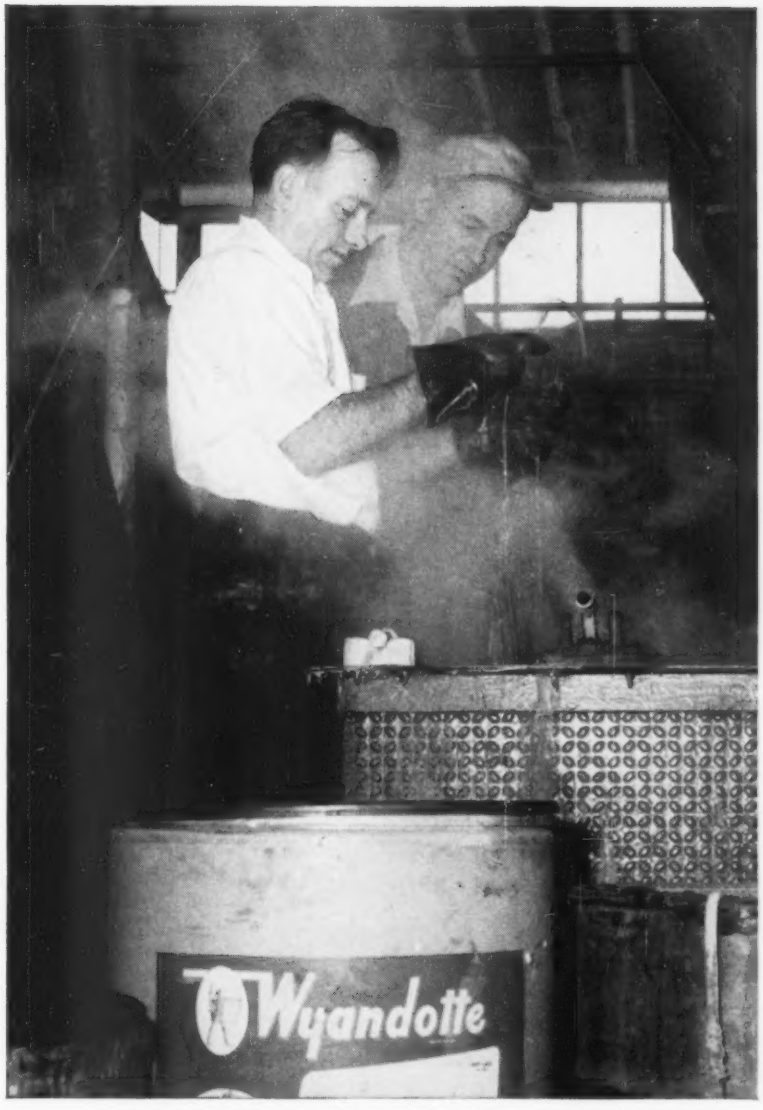
Wyandotte metal cleaners lick job shop's cleaning problems

Any plating operation, large or small, is faced with the problems of keeping production costs down, quality up. The Reliable Plating Corporation, Chicago, Illinois, uses Wyandotte metal cleaners, to help solve these problems, in a variety of standard job-shop applications. Says President J. Robert Greenwell: "Wyandotte Chemicals have done an excellent job for us for over fifteen years. We consider Wyandotte products the answer to job-shop cleaning problems."

Reliable Plating Corporation uses Wyandotte B.N. and C.S.R. for electrocleaning; Wyandotte W.L.G. for soak cleaning; Wyandotte 321 and Burnek 22 for barrel finishing. In each instance, Reliable reports: excellent cleaning and finishing; increased production through elimination of rejects; savings due to long solution life of chemicals; *definitely lower use-cost!*

Wyandotte B.N. is a superior, versatile electrocleaner for nonferrous, as well as ferrous metals. C.S.R.* is a unique reverse-current electrocleaner for removing smut from steel. W.L.G.* is outstanding for heavy-duty soak cleaning; removes even toughest soil deposits. Wyandotte 321, a soap-type compound, and versatile, economical Burnek 22 are excellent for ball-burnishing applications.

For research-developed and production-proved products that will improve the quality of your cleaning, and reduce operating costs, call your Wyandotte representative, now! *Wyandotte Chemicals Corporation, Wyandotte, Michigan. Also Los Nietos, Calif.* *REG. U.S. PAT. OFF.



Soak-cleaning operation at Reliable Plating Corp., Chicago, Illinois, is checked by Vice President Joseph B. Becker (right).

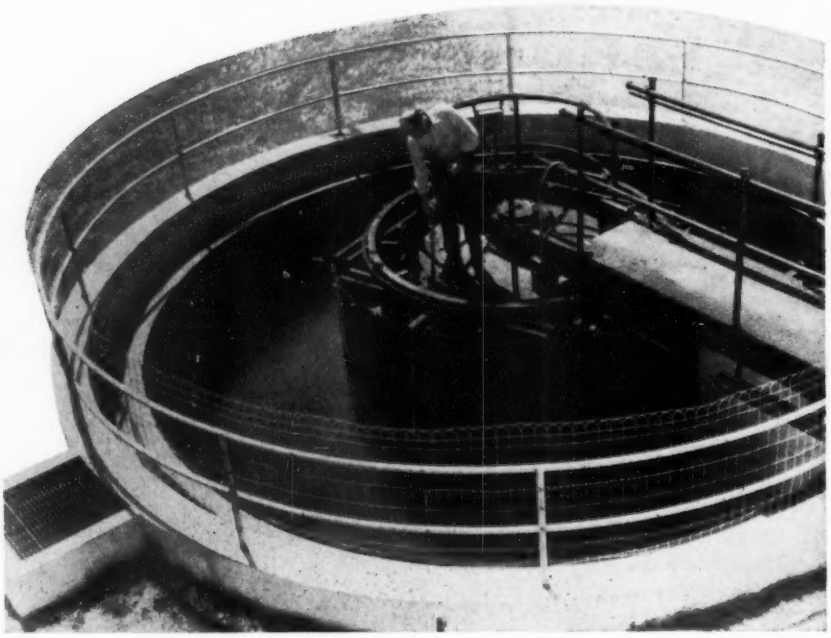
● *President J. Robert Greenwell, of Reliable Plating Corp., is also president of the National Federation of Metal Finishers; was chairman of the Chicago Electro-Platers Institute for two terms.*

Wyandotte CHEMICALS

Helpful service representatives in 138 cities in the U. S. and Canada

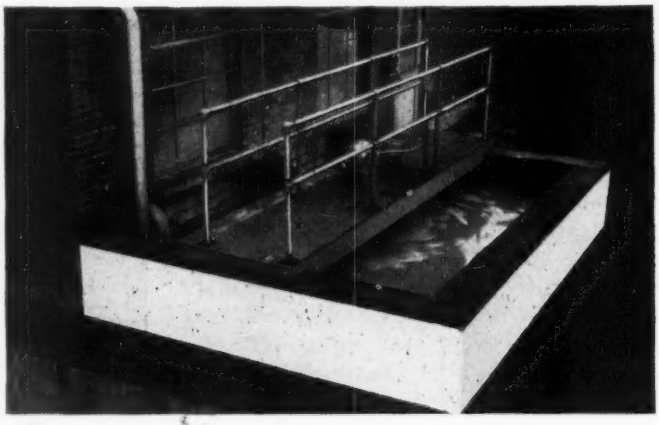
Largest manufacturers of specialized cleaning products for business and industry

Disposal of metal finishing wastes—as easy as 1-2-3!



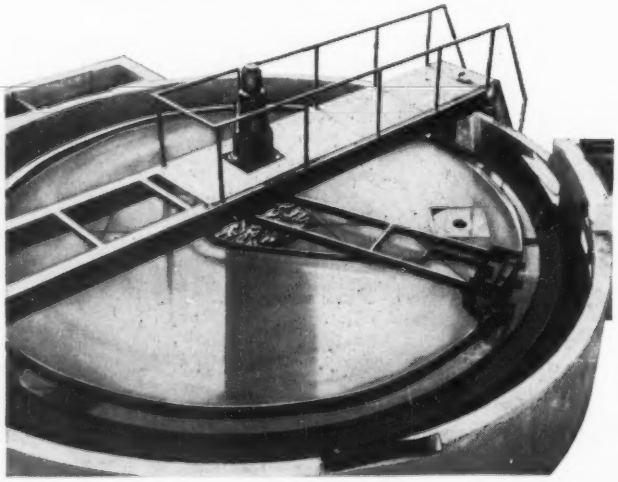
Treatment of pickle liquors, detergents, plating solutions, coolants and rinse waters is rapid and economical when you use INFILCO equipment. One or more of the units shown here will provide a permanent solution for your waste disposal problem.

1. CYCLATOR® Clarifier: A high-capacity unit for removing metals, soluble oils and suspended solids, and for pH adjustment.



2. VORTI-MIX® Circulator: For primary treatment of plating wastes which contain chromates and cyanide. Also applied to pickle liquor neutralization and cracking of oil emulsions.

3. PRIMARY CLARIFIER: For recovery of oil and removal of settleable solids when two stage treatment is required.



The proven success of this equipment in the metal finishing industry is your assurance of satisfaction. See your consulting engineer or write for complete information.

INFILCO INC.
912 South Campbell Ave.,
Tucson, Arizona
Offices in principal cities in North America

INFILCO

The one company offering engineered equipment for all types of water and waste processing—coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

5522A

HONITE Barrel Finishing Produces

Superfine Sanitary Finish!

Cherry-Burrell Corporation, Milwaukee Division, made large savings when they switched to the HONITE Barrel Finishing Method, *and* actually improved the sanitary finish necessary on their line of food processing equipment.

The milk filler tank shown below was formerly finished in two hand operations—grinding to remove weld splatter and generally improve the surface, and polishing to bring the surface down to 15 R.M.S. Recently, Methods Engineer, Ralph Wenger, supervised a change to the HONITE Barrel Finishing Method.

Results? The recommended HONITE procedure eliminated the polishing operation completely, and 60% of the rough grinding hand operation. Finishing time was cut 1½ hours . . . and finishes were improved to a superfine finish.

Your HONITE Methods Engineer or nearby HONITE distributor will show you how *you* can increase production and cut costs, too. Call him today!

Remember, too, the HONITE Division of the 3M Company supplies a *complete line* of abrasive chips, compounds and equipment for every barrel finishing need.

CHERRY-BURRELL METHODS ENGINEER, Ralph Wenger, holds a 40 lb. stainless steel milk filler tank. HONITE Barrel Finishing Method produced its superfine finish.

Honite BRAND

IT'S NEW!

MINNESOTA MINING AND MFG. CO.
DEPT. DS-75, ST. PAUL 6, MINN

☐ *Send me FREE copy of "Facts and Figures Report on HONITE Barrel Finishing"*

☐ *I'd like to talk with a HONITE Field Engineer*

Name..... *Title*.....

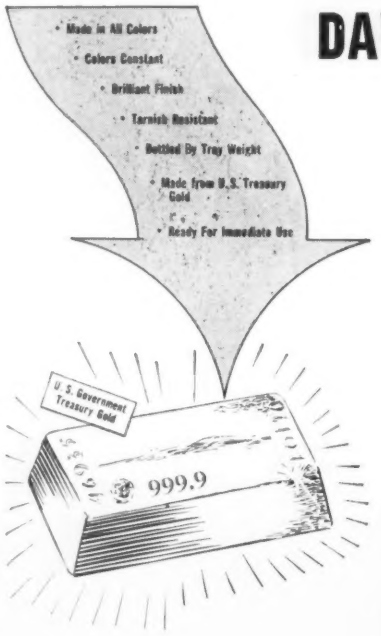
Company.....

Address.....

City..... *Zone*... *State*.....

Type of product to be finished.....

Made in U.S.A. by Minnesota Mining and Mfg. Co., General Offices: St. Paul 6, Minn. In Canada: P. O. Box 757, London, Ontario. Export Sales Office: 99 Park Ave., New York City. Makers of "SCOTCH" Pressure-Sensitive Tapes, "SCOTCH" Brand Magnetic Tape, "3M" Adhesives, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-slip Surfacing.



DAVIS-K GOLD PLATING SOLUTIONS

•

67% POTASSIUM GOLD CYANIDE SALTS

•

LUSTROUS WHITE RHODIUM SOLUTION

THE ONE OUTSTANDING DEVELOPMENT IN GOLD PLATING DURING THE PAST QUARTER CENTURY

DAVIS-K

ONE OPERATION

Antique Gold Solution

TANK RHEOSTATS: We are pleased to announce our variable type tank rheostats which are specially designed for precious metal plating.

DAVIS-K SERVICE: Our service today with its newly expanded facilities is fast and efficient. We are fully equipped to reclaim your old gold and rhodium solutions. Phone or write your precious metal problems. We welcome them!

"Where Glittering Elegance Reflects Lasting Quality."

100% PURE GOLD DKP PRECIOUS METAL SOLUTIONS

DAVIS-K PRODUCTS CO.

135 West 29th St. LOngacre 4-1978 - 9 New York 1, N. Y.

THE ANSWER TO YOUR TANK HEATING PROBLEMS

FOR ACID HEATING JOBS

G SERIES

FUSED QUARTZ IMMERSION HEATERS

Over 40,000 CLEPCO Fused Quartz Heaters now in service.

Dependable, controlled heat at low operating cost.

Wide range of Standard Sizes for every need.

Only Fused Quartz Heater recommended and sold by all leading plating supply houses.

FOR ALKALINE HEATING JOBS

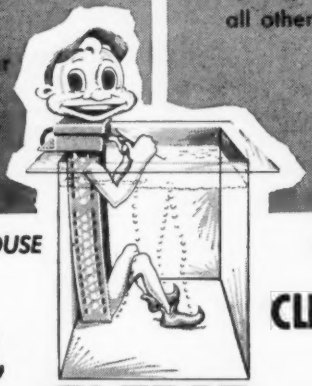
W & WS SERIES

STEEL AND STAINLESS IMMERSION HEATERS

Specify CLEPCO Non-Magnetic Stainless Steel Heaters for your alkaline electro cleaners and bright copper plating tanks.

Specify CLEPCO Steel Heaters for all other alkaline tanks.

All leading Plating Supply Houses can furnish from stock.



SEE YOUR PLATING SUPPLY HOUSE

WRITE US FOR LITERATURE

Clepco

CLEVELAND PROCESS COMPANY

1965 EAST 57th STREET

CLEVELAND 3, OHIO

Platers get improved chromate finishing

How to take better action against plating plant corrosives

Two groups of chemical resisting coatings can handle almost any application in plating plants.

Unichrome Plastisol Compounds can now be applied to any metal surface which can be uniformly baked. This has been made possible by Coating 5300, the first practical *sprayable* plastisol. It builds a protective film 20 mils thick in one coat, or thicker in multiple coats.

Combining the chemical inertness of vinyls with the pore-free, seamless, and mechanical protection of its resilient thick film, Coating 5300 can do many jobs for which sheet materials are used, and at less cost. Objects of dippable size can easily be protected with plastisol Unichrome Coating 218X, which so many plants already have on hand for coating racks.

Protection applied like paint

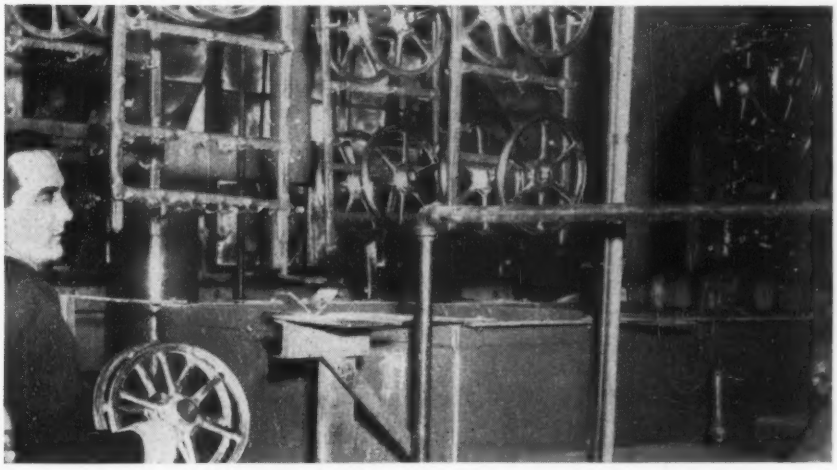
Various UCILON* Coating Systems because they're applied like paint, can do many jobs that plastisols cannot do, especially on large structural work. Ucilon Coatings include vinyl, phenolic, fish oil, neoprene, Thiokol, and chlorinated rubber types.

These coatings are intended for the kind of severe service conditions, high humidity and strong chemical solutions common to plating plants. They stand up, and keep the shop looking better longer . . . and for less money in the long run.

**Trade Mark*

UNITED CHROMIUM DIVISION
METAL & THERMIT CORPORATION
100 East 42nd Street, New York 17, N. Y.
Waterbury 20, Conn. • Detroit 20, Mich.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada:
United Chromium Limited, Toronto 1, Ont.

Matching of process to requirements simplified with wide line of Unichrome Dips



Economical, clear chromate finishing is being assured at the plant shown here because the chromate dip is matched both to the product and to the method of operation.

During chromate treating of zinc, the solution not only creates a corrosion resistant finish, but also strips away some of the zinc and chromate finish just formed. This chemical activity determines thickness of the finish, and therefore its corrosion resistance. It governs color and eye appeal, as well.

Composition of the chromate solution used and the time it has to act on the zinc affect results. Even the shape of the work can affect uniformity of results. The problem then is to get the one right solution for the operation.

THE RIGHT SOLUTION

Platers have found that satisfaction in chromate finishing is assured when the process matches the needs of the product being treated and the production setup.

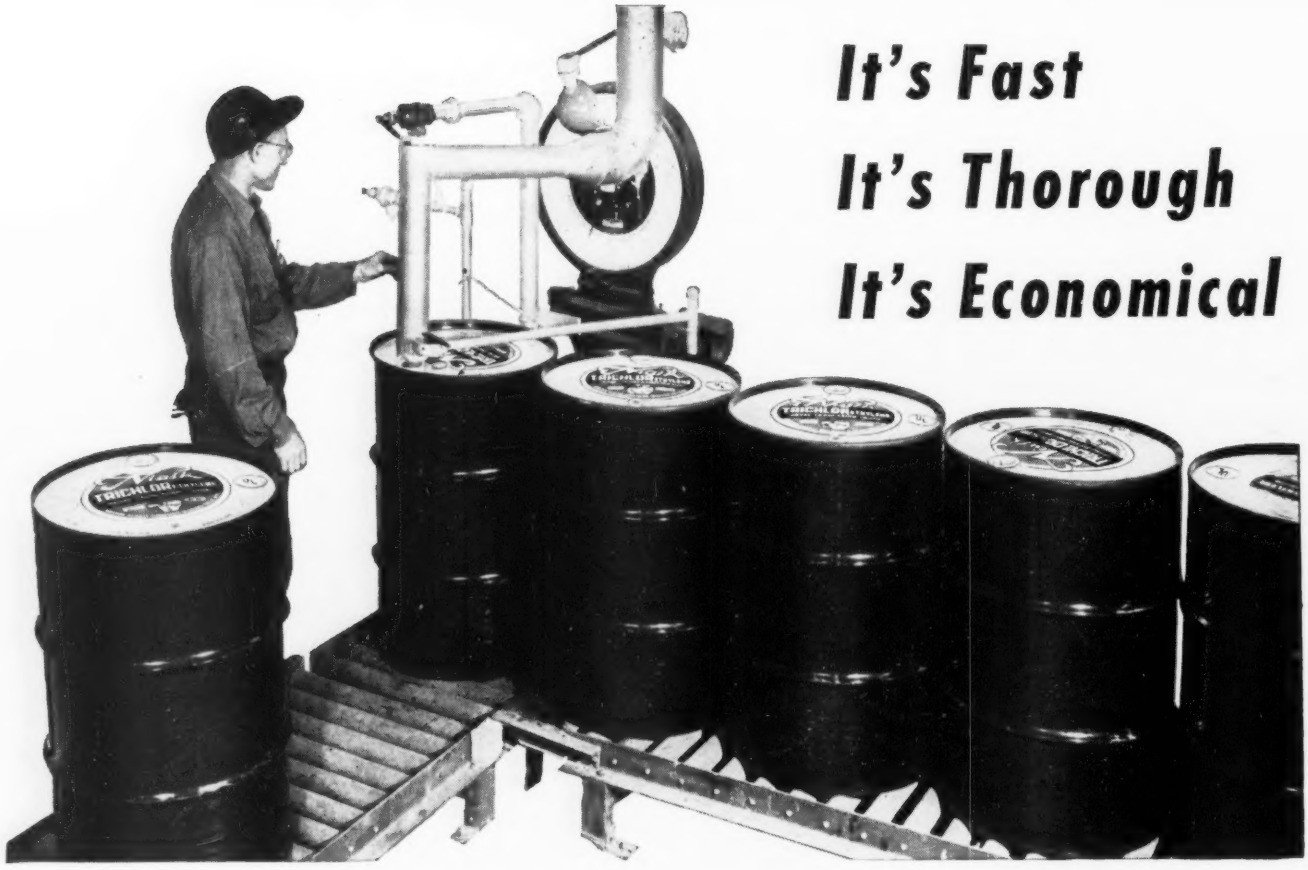
The unusually wide line of Unichrome Dips permits excellent matching to satisfy all requirements – corrosion resistance, eye appeal, color, type of equipment and the operating cycle.

SOLUTION ECONOMY

Chromate solutions contain various ingredients – some to control the solution, some to form the finish. But it is the chromating material which actually does the work. More chromate, more work done.

Unichrome Dips contain the optimum amount of the actual working material with just the right balance of control ingredients. That is why users are able to report materials savings, smaller additions for maintenance of concentration, longer service before discarding, and low cost per sq. ft. of finish.

Contact the nearest office of United Chromium for a chart of all the Unichrome Dips available, with the specifications they meet, and the colors they produce.



It's Fast
It's Thorough
It's Economical

It's your Best Buy in Degreasing Agents!

Nialk® TRICHLORethylene

When you stack up all the advantages offered by Nialk TRICHLORethylene you'll understand why more and more companies are standardizing on it for metal parts degreasing.

Versatile—the ideal organic solvent for removing practically every kind of foreign matter—waxes, greases, oils, gums, tars—even chips. Leaves parts clean, warm, dry, ready for assembly, inspection or surface treatment.

Fast—Acts quickly, cleans and dries rapidly. Its low boiling point (86.6°-87.8°C, based on standard ASTM tests) permits vaporization at low steam temperatures.

Thorough—Low viscosity (0.58 centipoises at 20°C) and low surface tension (about 29 dynes per cm at 30°C) assure diffusion into pores and relatively inaccessible openings.

Economical—Stable and completely usable after distillation. Cuts power consumption . . . can be heated by gas, steam or electricity. Gives concentrated vapor at only 188°F. Specific heat is less than ¼ that of water. Cuts vapor loss—high vapor density (4.5 times that of air) assures proper vapor level at all times.

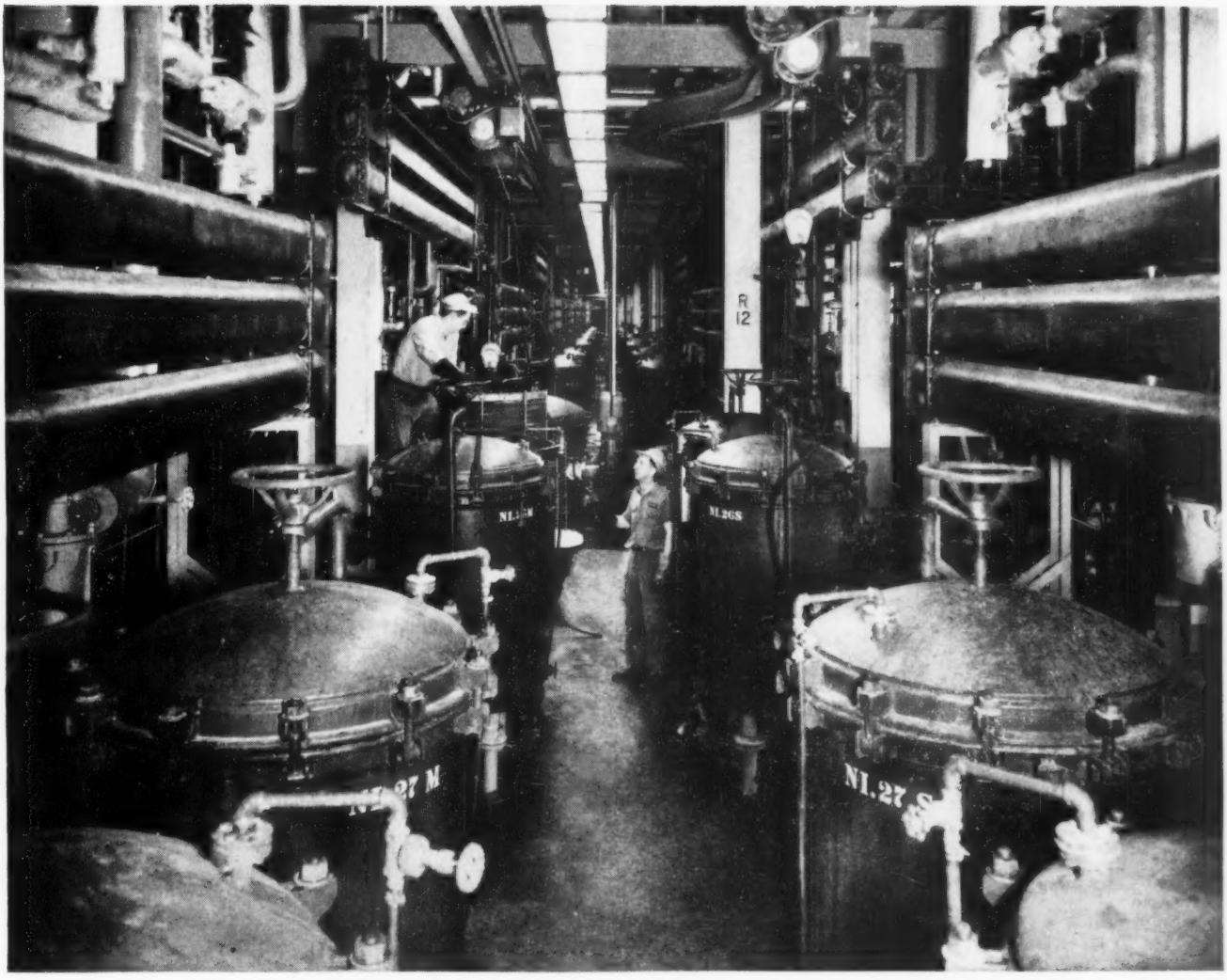
Safe—Has neither flash point nor fire point; classed as nonflammable at room temperatures, only moderately flammable at higher temperatures (Underwriters' Laboratories rating 3).

Order by the drum, carload or tank car. Deliveries can be made promptly. A request on your letterhead will bring you a free copy of our Nialk TRICHLORethylene booklet.

NIAGARA ALKALI COMPANY

60 East 42nd Street
New York 17, New York

NIALK® Liquid Chlorine • NIALK Caustic Potash • NIALK Carbonate of Potash
NIALK Paradichlorobenzene • NIALK Caustic Soda • NIALK TRICHLORethylene
NIAGATHAL® (Tetrachloro Phthalic Anhydride)



48 Sparkler Horizontal Plate Filters in this installation

Why do the largest plating plants in the world Choose SPARKLER FILTERS?

The answer is simple, and obvious to plating engineers.

First — the cake on a Sparkler Horizontal plate filter will not crack or fall off with a variation in pressure or with a complete shut down of filtering. ***Second*** — dry cake disposal eliminates the sewer problem. ***Third*** — the quick-change plate assembly reduces the down time for cleaning each filter to a matter of minutes.

This is why many of the world's largest plating plants use Sparkler Filters exclusively.

Plating engineers can get full cooperation at Sparkler on any size installations.

SPARKLER MANUFACTURING CO., Mundelein, Ill.

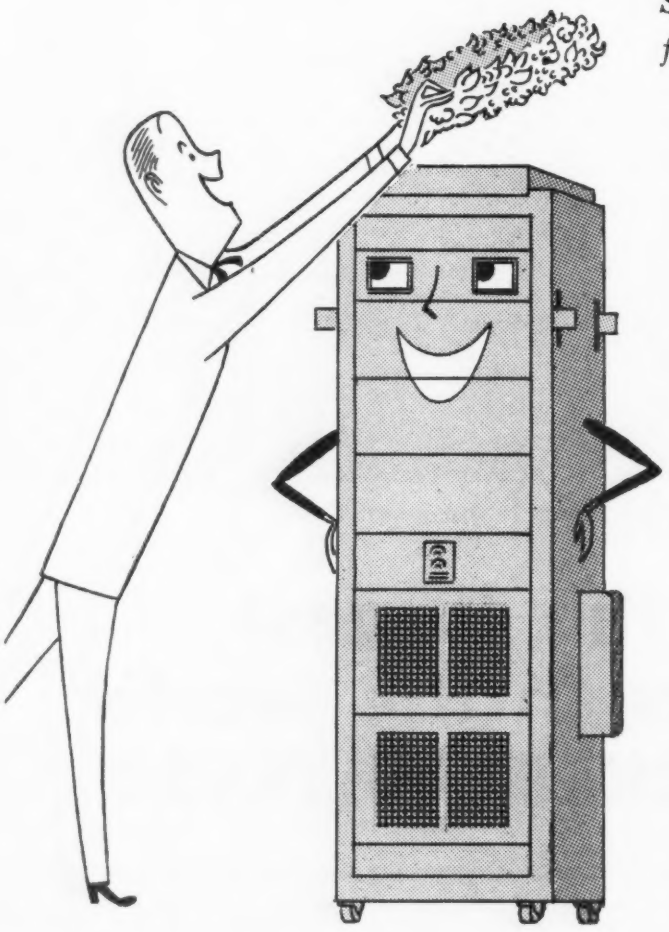
Filtration engineering and manufacturing has been our exclusive business for over 30 years

Manufacturing plants in Canada, Holland, Italy, Australia

Service representatives in principal cities throughout the world

DID YOU KNOW?

NEARLY EVERY FEATURE NOW AVAILABLE ON ELECTROPLATING RECTIFIERS WAS ORIGINATED BY GREEN ELECTRIC — AND MOST OF THESE OVER A DOZEN YEARS AGO



Some of the standard and special features in Munning-Green Rectifiers:

- Skyscraper cabinets to save floor space
- Caster mounting to simplify installation
- Meters and lamps at eye level
- Controls and pushbuttons at hand level
- Twin pairs of output terminals
- Automatic current overload protection
- High temperature visual and audible warning signals
- High temperature automatic shutdown
- Anti-single-phase protection
- Downdraft cooling
- "L" circuit for low ripple and high efficiency
- Dual input
- Dual, triple and quadruple output
- Pushbutton remote control
- Automatic voltage stabilization
- Automatic current stabilization
- Automatic ampere-hour control
- Automatic time control
- Factory-tested at full load
- Detailed instruction book
- Unconditional two-year guarantee

MUNNING-GREEN RECTIFIERS

. . . Best in the World!

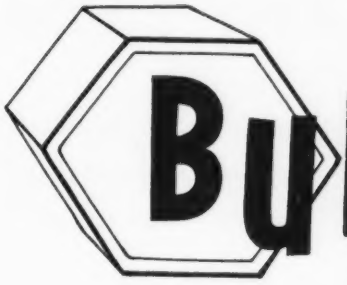
EXCLUSIVE SOURCE:

MUNNING & MUNNING INC.

202-208 EMMET STREET, NEWARK, N. J.

(Sales offices and distributors in principal cities)

FREE SAMPLE!



BURNAMITE*

*Trade Mark

***The Revolutionary* NEW**

BURNISHING & TUMBLING FORMULA

Specially developed to produce

the COLOR, LUSTRE *and* FINISH

***YOU* want on**

• ZINC DIE CASTINGS

. BRASS . COPPER . STEEL . WHITE METAL

. SOFT SOLDERS . ALUMINUM . ALUMINUM DIE CASTINGS

Works in All Hard Water Areas

BURNAMITE the Superior Homogeneous Burnishing Formula in powder form . . . developed after 3 years of intensive research. Now available in ample quantities for prompt delivery!

DISTRIBUTORS INQUIRIES INVITED

BARREL FINISHING DIVISION

RUTLEY *industries, inc.*

415 Greenwich St., New York 13, N. Y.
Phone: WAlker 5-4600

MAIL THIS HANDY COUPON TODAY!

RUTLEY Industries, Inc.
415 Greenwich St., New York 13, N. Y.

Please send FREE BURNAMITE Sample to:

NAME: ..... TITLE: .....

FIRM: .....

ADDRESS: .....

CITY: ..... ZONE: ..... STATE: .....

FREE! Handiest Buffing Helper Ever Offered!

What Type?

What Diameter?

What Speed?

American Buff Company's NEW SISAL BUFF SELECTOR

Selects the right buff... the right speed... the right size... Quick as a wink!

Here's the buffing man's best friend—a quick, convenient "know-it-all" that answers practically any buffing question. With a simple twist of the dial, you can instantly find the recommended types of Sisal Buffs for most common finishing jobs on Automotive Parts, Housewares, Appliances, Metal Furniture, etc. Selections are shown for automatic and semi-automatic machines, as well as hand buffing. On the back is a rapid Calculator for correct sizes and speeds. Get this handy 2-in-1 tool to help you get the right buff—every time!

FREE to Buff Users
... write for yours today!

"For the Job that's TOUGH, Use an AMERICAN BUFF"

American Buff Company
2414 S. La Salle Street • Chicago 16, Ill.

BOOKS FOR YOUR PLANT LIBRARY

PRINCIPLES OF ELECTROPLATING AND ELECTROFORMING
REVISED THIRD EDITION
$7.00 PER COPY

•

METALLIZING NON-CONDUCTORS
$2.00 PER COPY

•

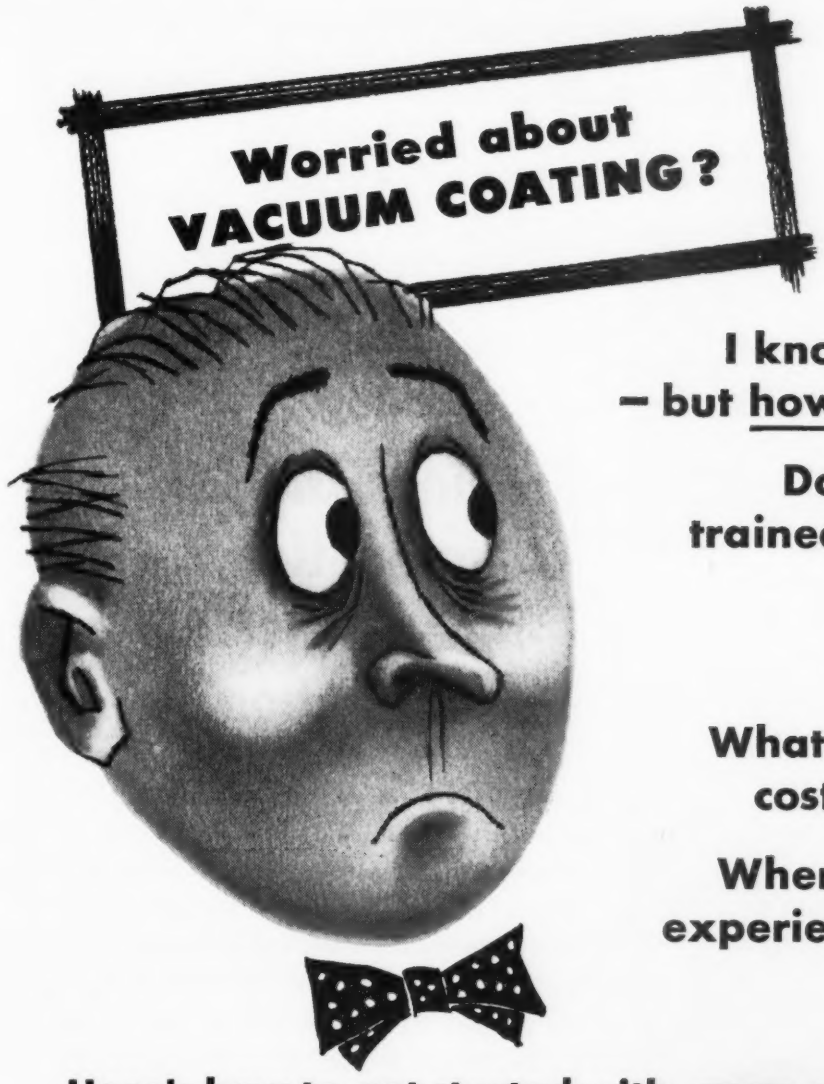
DICTIONARY OF METAL FINISHING CHEMICALS
$3.00 PER COPY

•

1955 METAL FINISHING GUIDEBOOK-DIRECTORY
$3.00 PER COPY

Book Orders Payable in Advance

FINISHING PUBLICATIONS, INC.
381 Broadway Westwood, N. J.



I know it's low cost – but how do I get started?

Do I need trained operators?

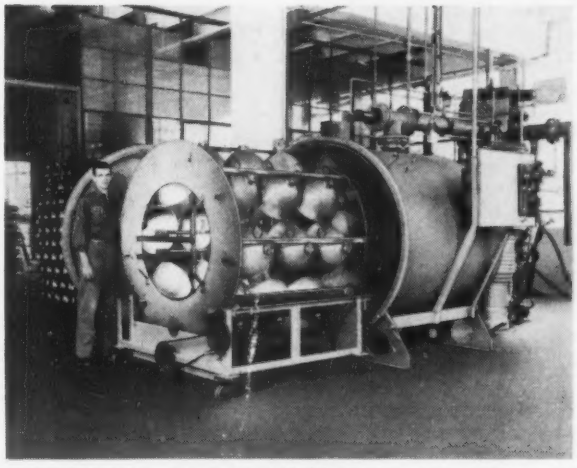
What's the story on lacquers?

What will my costs be?

Where do I get experienced advice?

Here's how to get started with low-cost vacuum coating . . .

It is really quite simple. National Research technicians have a great store of vacuum coating experience available for your use. They are experience-equipped to design a *complete vacuum coating system* for you. Give you an idea of your costs ahead of time. Supply you with a vacuum-coated sample of your product. Make the installation. Advise on lacquers. Train operators. Stand by to help you quickly get into profitable production. Here's the easy, sure way to use the latest, low-cost method of coating metals and plastics with beautiful metallic coatings. Send coupon.



Reflector finishing costs dropped 75% when this National Research vacuum coater replaced electroplating.

NRC

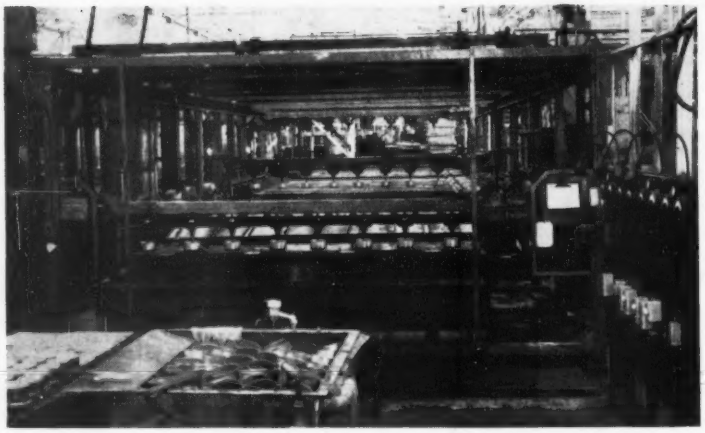
NARESCO
EQUIPMENT
CORPORATION

SALES OFFICES
Boston, Chicago, Cleveland, Houston, Los Angeles, New York, Palo Alto, Philadelphia; in Canada: Toronto, Arnprior

NARESCO EQUIPMENT CORPORATION
Equipment Sales Subsidiary of National Research Corporation
Dept. 137, Charlemont St., Newton Highlands 61, Mass.
Please send me the "Rapid Cycle" Vacuum Coater Bulletin.

Name_____ Title_____
Company_____
Address_____
City_____ State_____

New High Standards in Plating • Processing • Cleaning



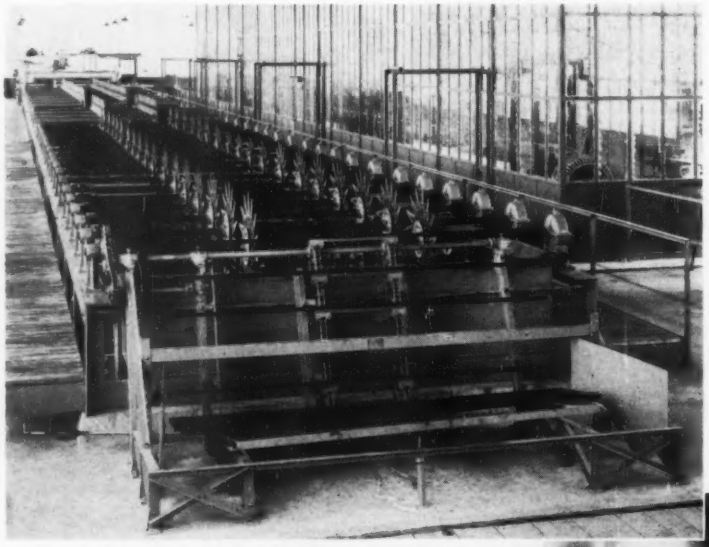
U.S. Fully Automatic Equipment for processing and heavy copper plating the bottoms of popular brand stainless steel cooking utensils. 10 such U.S. installations are in service in 3 plants of this manufacturer.

EQUIPMENT

Since 1896

Provides the Right Combination for More Efficient Operation

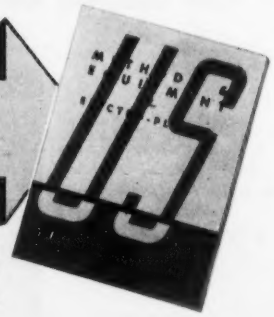
U.S. Equipment leads where production problems call for ingenious engineering and design for improving quality and lowering costs. Whether your job calls for Electroplating, Electrochemical Treatment, Metal Cleaning, Pickling, Acid Dipping, Drying or other related operations in any required series or combination —intermittent or continuous—it will pay to get U.S. recommendations. Our Service Department is at your disposal, without obligation.



U.S. Fully Automatic Conduit Pipe Processing Installation. Performs 24 operations in one continuous cycle including cleaning, acid treatment, zinc plating pipe exterior, enamelling and baking interior surface. Capacity—over 60 million feet of pipe per year. Glass enclosure houses U.S. Generator Equipment.

U.S. Automatic Machine for processing tubular steel furniture components. Performs 22 operations automatically including cleaning, copper, nickel and chrome plating and drying in one continuous cycle. Has 5 parallel processing lanes; each can take different kinds of material.

Write for this FREE Brochure



U. S.—A Complete Line of Plating Barrel, Still Tank, Variable Speed, Semi- and Fully Automatic Equipment • Motor Generators & Rectifiers

U. S. GALVANIZING AND PLATING EQUIPMENT CORP.

31 HEYWARD STREET INCORPORATED 1896 BROOKLYN 11, N.Y., U.S.A.

WESTWOOD, N. J.
WHERE PLATERS AND FINISHERS LOOK FOR INFORMATION
FINISHING PUBLICATIONS, INC.

METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

JULY, 1955 Volume 53 Number 7

FEATURES

Editorial — There's Nothing Wrong with Bronze Plate 43

Electrodeposition of Nickel from Fluoborate Solutions 44
By Dr. C. B. F. Young and William Strobach

Bronze Plating: Why and How 51
By Dr. Frederick A. Lowenheim

The Slot Cell 53
By J. B. Mohler

Oil Derrick Marks Chromium Tank 59
By Fred A. Herr

Electroless Chromium 62
By Harry J. West

Science for Electroplaters — Part V 64
By L. Serota

DEPARTMENTS

Shop Problems 67
Patents 69
Abstracts 72
Recent Developments 74
Business Items 83
Associations and Societies 91
News from California 96
Manufacturers' Literature 98
New Book 101

Published Monthly By

Finishing Publications, Inc.

Established in 1903 as Metal Industry by Palmer H. Langdon 1868-1935.
Also publishers of ORGANIC FINISHING and annual GUIDEBOOKS and DIRECTORIES.

381 Broadway, Westwood, N. J.
WEstwood 5-1530

L. H. Langdon, *President-Trecsurer;* Palmer H. Langdon, *Publisher;* Thomas A. Trumbour, *General Manager;* Joan T. Wiarda. *Sales Manager;* Nathaniel Hall, *Technical Editor;* Fred A. Herr, *Pacific Coast Editor;* John E. Trumbour, *Equipment & News Editor;* Inez Oquendo, *Assistant Editor;* Elizabeth Meyers, *Circulation Manager.*

BRANCH OFFICES

Los Angeles 14, Calif.
219 West 7th St.
MAdison 6-5421

Hornell, N. Y.
19 Elmwood Place
Hornell 943

SUBSCRIPTION INFORMATION

United States and Canada $4.00 per year, other countries $8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 23rd edition 1955 current, 588 pages 5¼x7⅞ $3.00. A copy of this book is included with subscription. Please remit by check or money order; cash should be registered. Request for change of address should reach us or or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Copyright 1955 by Finishing Publications, Inc. All rights reserved. Contributed articles, letters on pertinent subjects are invited. Their publication, however, does not necessarily imply editorial endorsement. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

Member

BPA Business Publications Audit

NBP National Business Publications

Society of Business Magazine Editors

Luster-on®

The original bright conversion coating for zinc and cadmium

NOW PROUDLY OFFERS ALUMINUM PROTECTION

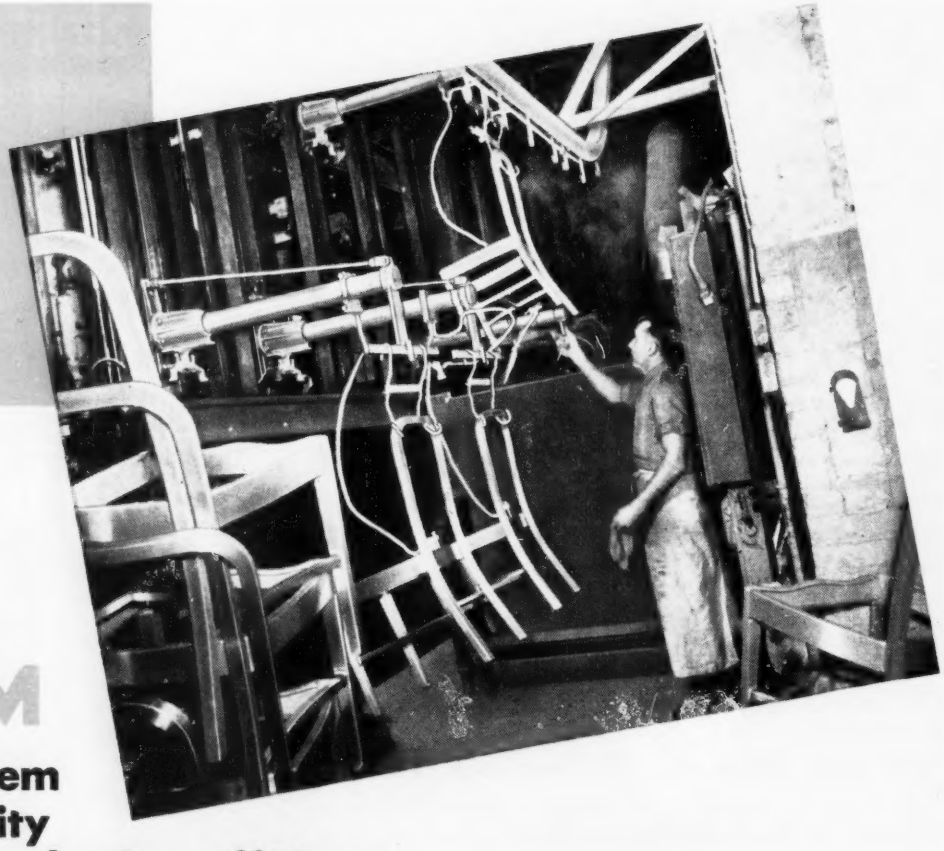
in either clear or colored finishes with

New **Luster-on®** Aluminum Sealer

- Replaces anodizing where hardness is not prime factor
- Can be used as a finished treatment — or as a paint base
- Gives salt spray resistance to 600 hours
- Applies easily in one dip at room-temperature
- Adheres well, does not leach easily
- Offers extreme economy of use

Send samples for free laboratory treatment. See superior results with your own eyes.

THE *Chemical* CORPORATION
58 WALTHAM AVENUE, SPRINGFIELD 9, MASS.



Operator at Art Metal Construction Co. places chair parts on one of the carrier arms which travel through the various treatments in the one-hour 20 min. cycle.

H-VW-M

anodizing system combines quality control and production efficiency for metal chair manufacturer

When, eight years ago, Art Metal Construction Co., Jamestown, N. Y., began experiments in the manufacture of aluminum office chairs, they turned to H-VW-M for a completely automatic aluminum anodizing system that exactly fitted the requirements of the job it had to do, and the space available to house it.

Art Metal had never before manufactured chairs. Today they are among the leaders in this field. The H-VW-M Automatic Anodizing System, still operating perfectly after eight years, is credited to a large degree for the quality and uniformity of their finished product. In the highly competitive office furniture field, a metal finish may mean the difference between product acceptance or rejection—and the H-VW-M aluminum anodizing system provides the perfect finish for Art Metal, every time. Moreover, thousands of dollars in yearly production savings result from the completely automatic operation. One man services the entire system.

Whether your finishing problem, like that of Art Metal Construction Co., can be solved best with a completely automatic anodizing system, or whether still tank aluminum anodizing operations most economically fit your particular needs—H-VW-M has the answers. A complete engineering service, combined with a complete line of equipment, processes and supplies, make H-VW-M the headquarters for everything in aluminum anodizing—at any stage, from planning to production.

PLATEMANSHIP

Your H-VW-M combination—of the most modern testing and development laboratory—of over 80 years experience in every phase of plating and polishing—of a complete equipment, process and supply line for every need.

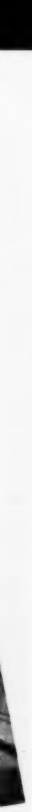
HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, N. J.
Plants: Matawan, N. J. • Grand Rapids, Mich.

SALES OFFICES: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Boston Bridgeport • Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville • Matawan • Milwaukee New York • Philadelphia • Pittsburgh • Plainfield • Rochester St. Louis • San Francisco • Springfield (Mass.) • Utica Wallingford (Conn.)

1712

H-VW-M

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES



METAL FINISHING

DEVOTED EXCLUSIVELY TO METALLIC SURFACE TREATMENTS

ESTABLISHED 1903 VOLUME 53 • NUMBER 7 • JULY, 1955

There's Nothing Wrong with Bronze Plate

We have remarked, on numerous occasions, about the likelihood of the nickel shortage existing for a long time to come, despite continued expansion in mining and refining facilities. Comments have been made and suggestions offered towards maintaining quality with the limited amount of nickel available. The use of bronze as a substitute for the copper undercoat and part of the nickel deposit, however, does not appear to have received the consideration which its proven effectiveness warrants.

Although production of commercial copper-tin deposits goes back over twenty years, very few installations were attempted, due to the necessity to employ separate anode circuits for the copper and tin anodes, with close control required over their voltages as well as over the solution itself. Besides, we usually had plenty of nickel at our disposal. The recent development of two baths which obviate dual anode circuits, offers the plater a process requiring no more control than any of the standard procedures he has followed in the past.

The pyrophosphate bath uses bronze anodes, while the cyanide-stannate bath is operated with copper anodes, the tin content ordinarily being maintained by additions of copper stannate. Both baths will produce deposits, either dull or bright, containing about 10 per cent tin, and at plating rates comparable to high speed copper and bright nickel processes. Querying polishers in the course of our travels, we can usually figure on obtaining a good consensus from the practical standpoint, even though the results are subjective rather than scientific. Polishers appear to be well satisfied. The bronze deposits are sufficiently hard so that they do not "drag" under the buff, and sufficiently "flowable" to fill in emery and die marks in the basis metal. Unbiased tests have shown that a bronze undercoat permits the use of much thinner nickel deposits without any sacrifice of corrosion resistance, and further remarks in this connection will be found in an article appearing in this issue.

Because of the higher operating cost, bronze probably will make very little inroad where copper is applied to articles either for buffing or as a coating for zinc base die castings prior to bright nickel, where no corrosive environment is anticipated in service. For those articles on which nickel deposits of the order of one to two mils have formerly been indicated, especially for outdoor service, the number of plants applying bronze deposits is growing rapidly and with good reason.

Nathaniel Hall

Electrodeposition of Nickel from Fluoborate Solutions

By C. B. F. Young, Ph.D.* and William Strobach, M.Ch.E.**

ELECTRODEPOSITION of lead from fluoborate solutions is old in the art, having been first described by Leuchs in 1886 and fully discussed by Blum et al some thirty years ago and again more recently by Gray & Blum in 1941. In these older researches it was necessary to prepare the solution by dissolving the metal in fluoboric acid, which itself had been prepared by reacting boric acid with hydrofluoric acid. Lately, however, various purified, concentrated metal fluoborate solutions have appeared on the market which usually require only dilution with water and some relatively simple additions to put them into operating condition, and it is with these that the recent investigators have mainly concerned themselves.

A review of the trade and technical literature shows the following advantages demonstrated or claimed for the metal fluoborate concentrates over the more conventional plating solutions and although, as stated before, data for the nickel fluoborate solution has not been specifically included in previous published researches, similar advantages for it may be expected:

1. Simplicity of preparing the bath from the concentrate.
2. Stability of the bath composition.
3. Practically 100% anode and cathode efficiency.
4. Ease of analytical control.
5. Possible operation at relatively low temperatures.
6. Fine grained deposits of good color.
7. Good covering power.
8. High conductivity.
9. High speed operation.
10. High tolerance for impurities.

Against these advantages one may set down the following, if not all as proven disadvantages, at least as items to which attention has been called and which warrant consideration and possible further investigation:

1. Shipping conditions more critical for the liquid concentrate as compared to the conventional solid salts.
2. Higher cost per gallon of plating solution.
3. Reputed low throwing power. (See item 7 above.)
4. Reputed nuisance hazard of fumes given off from solution, from standpoints of health and corrosiveness to equipment.
5. Incompatibility with some types of addition agents and with some of the materials normally used in purification treatments.
6. Inability to use glass electrode for pH control.

Some of the above items will be included in the present investigation and further discussed in later sections.

Formulas and Plating Conditions

The formulas and conditions originally suggested for trial in nickel plating baths were as follows:

	Low Conc.	*High Conc.*
$Ni(BF_4)_2$	220 g./l.	440 g./l.
$Ni(BF_4)_2$ conc. 50% (as furnished)	440 "	880 "
$NiCl_2$	15 "	15 "
Brightener	0.5 "	0.5 "
pH	2.0-2.5	2.0-2.5
Temperature	130-140°F.	130-140°F.
	55-60°C.	55-60°C.

Saccharin was suggested as brightener, additions to be made as determined by the appearance of a test plate. Efficiencies of 100% for the anode and 98-99% for the cathode were indicated. Bagging of anodes and continuous filtration for obtaining smoothest deposits were recommended. Although rolled depolarized anodes were preferred, electrolytic anodes had been used with fair success.

Later, the following further information on typical plating baths of nickel fluoborate was obtained, with the understanding that this should not be interpreted as a final, recommended procedure.

	Bath A Low	*Bath B Medium*	*Bath C High*
$Ni(BF_4)_2$, g./l.	220	300	440
Ni, g./l.	55	75	110
Free HBF_4, g./l.	4-38	4-38	4-38
Free H_3BO_3, g./l.	30	30	30
pH (Colorimetric)	2.0-3.5	2.0-3.5	2.0-3.5
Temperature	38-77°C.	38-77°C.	38-77°C.
	100-170°F.	100-170°F.	100-170°F.

Under the above conditions good anode corrosion

*Formerly Adjunct Professor, Brooklyn Polytechnic Institute. Now President, Auromet Corporation, New York City.

**Engineer, The S. S. White Dental Manufacturing Co., Prince Bay, Staten Island, N. Y.

Submitted in partial fulfillment of the requirements for the degree of Master of Chemical Engineering at the Brooklyn Polytechnic Institute of Brooklyn.

of about 100% efficiency at usual commercial current densities had been obtained with either rolled depolarized or cast carbon nickel anodes. Difficulties had been experienced with electrolytic nickel anodes. Anode efficiencies were low at temperatures below approximately 50°C. (approx. 120°F.). With the usual commercial anodes, the pH of solutions had been maintained for long period of time. No gassing had been noted at the anode in some work conducted at about 120 amp./sq. ft. anode current density. The acidity of the solution had been found to affect anode corrosion with pH values of 3.8 to 4.0 having a tendency to cause gassing.

It was decided in the present work to investigate the effect of some variables as bath composition and concentration, temperature, current density, pH, agitation, and addition agents. Some tests on the hardness and ductility of the deposits, their uniformity of thickness as coated, and their ability to be buffed and to accept a chromium plate were also to be conducted. Furthermore, comparison was to be made with deposits obtained under as similar or equivalent conditions as possible from both a conventional Watts nickel bath as well as from one of the commercial, organic addition agent type of bright nickel solutions. This comparison was to include, in addition to the factors mentioned above, some judging of the relative throwing and covering powers of the various solutions and of the economic aspects involved in their commercial use. Finally, some work on the analytical control of the nickel fluoborate solution was contemplated.

Plating Apparatus and Electrodes

The bulk of the experimental plating was conducted in either of two pieces of apparatus. One of these was the conventional Hull cell. The anodes used were flat nickel sheets approximately 2½" x 3" x 0.050" thick. The cathodes were also flat sheets, about 2½" x 4" x 0.037", and either polished and buffed copper or brass or polished cold rolled steel was used. The volume of solution used with the cell was held very close to 267 ml. as recommended and, in most of the tests, the solution temperature was controlled to within 0.5°C. by keeping the cell in an agitated, thermostatically regulated water bath.

The other apparatus, designed for experiments with rotating cylindrical cathodes, consisted of a 400 ml. Pyrex beaker equipped with a cylindrical sheet nickel anode formed to hug the inside glass wall of the beaker. With this cell, the cathodes used were metal cylinders, either of polished or buffed brass or polished steel, which were centrally suspended in the beaker by means of a Bakelite rod and to which current was supplied by means of copper wire insulated by stop-off lacquer except at the contacts. The wire was tightly wound around the rod, the upper end of which was held in the chuck of a variable speed motor equipped with a gear box reducer. The speed of rotation was checked by means of a tachometer on each trial and was maintained within 3% of the nominal value. The hole through the cylindrical cathode was plugged by means of a tight-fitting rubber stopper so that only the outside area of the cathode was exposed for plating. The entire cathode assembly was easily removable and carried through the cleaning cycle prior to plating, a new cathode being used for each test. The same thermostatic water bath was used to control the solution temperature during these trials as described above for the Hull cell tests. The solution volume while plating was maintained at 250 ml. ± 10 ml.

The cylindrical cathodes used were either of 60-40 yellow brass or SAE 1112 cold rolled steel. The material was received as tubing stock manufactured to close dimensional limits and the cylinders after being cut off to desired length were individually polished to what would be considered a typical good finish for plating. The final polishing operation for brass consisted of a buffing on a loosely sewed muslin wheel with a regular brass buffing composition while, in case of the steel specimens, the final polishing was done on a #220 grit set-up wheel using a flour emery paste stick. The flat plates used for Hull cell and throwing power tests were similarly prepared.

Two sizes of cylindrical specimens were used for both brass and steel. In the case of brass, the smaller size was 0.5625" o.d. × 0.75" long × 0.030" wall having a plated area of 1.43 in.^{2} The larger one was 1.125" o.d. × 1.00" long × 0.030" wall with an exposed area of 3.75 in.^{2} The steel cylinders were 0.5625" o.d. × 0.75" long × 0.020" wall having an outside area of 1.394 in.^{2} and 1.25" o.d. × 1.00" long × 0.094" wall with a plated area of 4.07 in.^{2}.

The anodes used with the cylindrical cathodes, as stated before, were also cylindrical in shape. In most of the tests, since relatively high cathode current densities were to be used and it was desired to maintain rather low anode current densities so that cell voltages would primarily reflect conditions at the cathode as well as conductivity of the solution, the anode used was about 2.875" in diameter × 2.375" long with an exposed area of 21.45 in.^{2} Since the anode fitted tightly against the inside of the glass vessel, only the one side facing the cathode was exposed. This gave a cathode: anode ratio of exactly 1:15 with the small brass cathode which was used for most of the work, a ratio which is not out of line with that found in many commercial nickel plating installations. In the case of the small steel cylinder, the ratio is substantially the same whereas, with the larger cylindrical specimens, either brass or steel, the cathode : anode ratio was roughly 1:5.5. In a few of the tests, anodes were used which gave cathode: anode ratios of 3:1.

The inter-electrode distances were about 1.15" and 0.875" respectively when the smaller or larger cylinders were used. The standard Hull cell inter-electrode distance and cathode : anode area ratio were, of course, used.

Preparation and Control of Solution Composition

The nickel chloride and boric acid, where added, were of c.p. reagent grade and the fluoboric acid used was that supplied in the special purified grade described previously. The volume of solution usually prepared was 300-400 ml. the excess over that employed in the trial being set aside for replacement purposes to make up for drag-out and samples withdrawn for analysis, pH determinations, etc.

Constituent	Watts High pH Solution grams/liter	oz./gal.	Organic Bright Nickel Solution grams/liter	oz./gal.
$NiSO_4 \cdot 6H_2O$	227.0	30.3	290.0	38.6
$NiCl_2 \cdot 6H_2O$	52.5	7.0	60.0	8.0
Metallic Ni	63.8	8.5	79.5	10.6
Cl	15.6	2.1	17.9	2.4
H_3BO_3	30.0	4.0	37.5	5.0
Brighteners	None		As specified by vendor	
Wetting Agent	None		As specified by vendor	
pH, Electrometric	5.3		3.8	
Surface Tension dynes/cm.	71.7 @ 25°C.		40.5 @ 30°C.	

As the volume of each solution used was quite small, new solutions were made up as often as the rather limited supply of concentrate allowed. In no case was a solution used if there was any indication that the concentration of any of its constituents had been materially affected by previous tests.

For comparison of the results obtained from the experimental solutions, tests were made using samples of solution withdrawn from both a Watts high pH nickel bath and a commercial organic bright nickel bath. The composition of these solutions was as shown in above table.

Control of pH

As indicated above, the pH of the Watts and bright nickel baths was determined electrometrically. As stated in the literature and confirmed in the present investigation, fluoborate solutions affect the glass electrode to such an extent that the latter cannot be used for pH determinations. A special salt bridge which enables the pH of these solutions to be read by means of quinhydrone and the platinum electrode has been described. However, in the present work colorimetric methods were employed instead. Both pH papers and buffer solutions with indicators were used. Determinations with the pH papers were only approximate, in some cases estimates no closer than about 0.5 pH unit being obtainable. However, the papers were found to be a quick, convenient way of following the general course of pH changes during treatments with nickel carbonate, etc.

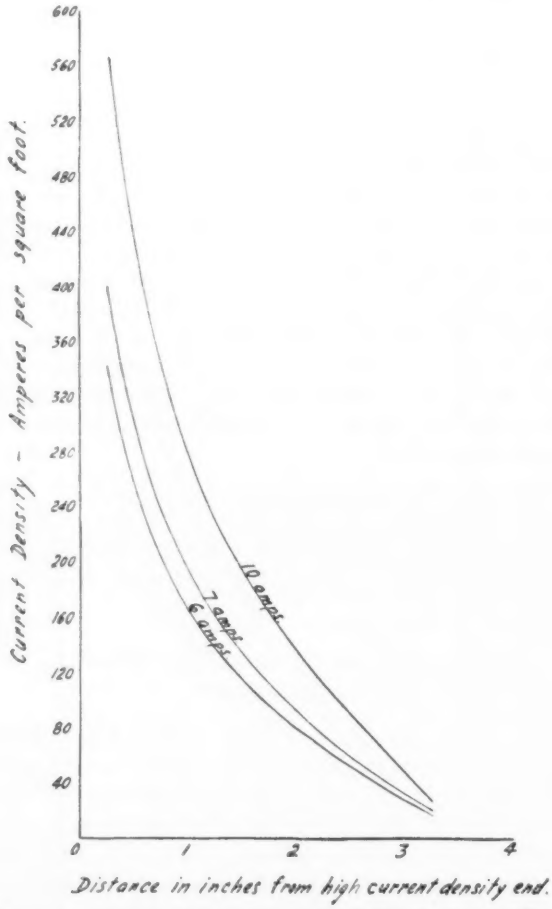


Figure 1. Current density curves for Hull cell plates. For total currents of 6-7-10 amperes.

Treatments Prior and Subsequent to Plating

The polishing and buffing of the cathodes has already been described.

The specimens were cleaned immediately after the polishing operation in vapor-slush type trichlorethylene degreaser. After degreasing, the parts were very carefully wiped with a clean, lint-free cloth and stored in a dessicator until needed for plating.

The following cleaning cycles were used for both flat and cylindrical samples prior to plating:

Ferrous Specimens

1. Alkali soak cleaner — 5 min. at 80-90°C.
2. Anodic alkali cleaner — 2 mins. at 6 volts and 80-90°C.
3. Warm water rinse.
4. 50% HCl dip.
5. Cold water rinse.
6. Cyanide dip — 4 oz./gal. NaCN.
7. Spray water rinse.
8. 5% H_2SO_4 dip.
9. Spray water rinse.
10. Running distilled water rinse.

Non-Ferrous Specimens

1. Alkali soak cleaner — 5 mins. at 80-90°C.
2. Cathodic alkali cleaner — 2 mins. at 6 volts and 80-90°.
3. Warm water rinse.
4. Cyanide dip — 4 oz./gal. NaCN.
5. Spray water rinse.
6. 5% H_2SO_4 dip.
7. Spray water rinse.
8. Running distilled water rinse.

The alkali cleaners used were proprietary ones and

different solutions were used for ferrous and non-ferrous parts at the concentrations recommended by the vendor and proven satisfactory for the purpose by years of commercial application. Attention is called to the fact that the final rinse prior to plating was one using running distilled water so as to eliminate any possible drag-in of contaminants into the relatively small volume of plating solution.

After plating, the cathodes were rinsed off with a small amount of distilled water from a wash bottle to reduce drag-out losses. After disassembling, they were then washed in running water, dried off, and stored in a dessicator.

The Hull cell used for much of the experimental work has also been described previously but some further explanation of the specific application here will now be given (Fig. 10).

Hull recommends generally the use of a total current of 2 or 3 amperes and a plating time of ten to 15 minutes. This gives a deposit on the cathode, which is inclined at a definite angle with respect to the anode, illustrating current densities up to about 90 amp./sq. ft. for 2 amperes and about 160 amp./sq. ft. for 3 amperes. Although the ranges indicated are ample for ordinary control work with Watts or modified Watts solutions such as the usual organic type bright nickel baths, they are not high enough for the present work involving experiments with much greater current densities.

Accordingly, higher amperages were used in some of the tests and the corresponding current density values were calculated by the following formula given by Hull and MacIntyre:

$$A = C\ (27.7 - 48.7 \log L).$$

where A = current density at the selected point.
C = total current applied to the cell.
L = distance in inches of the selected point from the high current density end of the cathode plate.

(It is noted that the equation applies only to values of L from ¼" to 3¼".)

The calculated values have been plotted as Fig. 1, which was then used directly for reading the various current densities from those plates for which the higher currents were used. Fig. 2 gives similar curves used with total currents of 2 and 3 amperes and these correspond closely to those published in the aforementioned literature. Curves for other values of total currents up to 5 amperes are also shown on Fig. 2.

As suggested by Hull and found expedient for the present purpose in the interests of uniformity, only a portion of the cathode plate was used for observing and recording the results. A template was made up and used so that only that portion of the plate from ¾" to 1½" from the bottom and from ½" to 3¼" from the high current density end was visible. At the same time, it was felt that the condition at the extreme high current density end of the plate would be significant and the nature of the deposit there was also observed.

In order to maintain the number of coulombs used per test at a definite, constant value so that the effects on the solution as well as on the nature of the deposit could be evaluated, the time of plating was adjusted so as to maintain the current passed at 20 ampere-minutes. No agitation was used in any of the Hull cell tests.

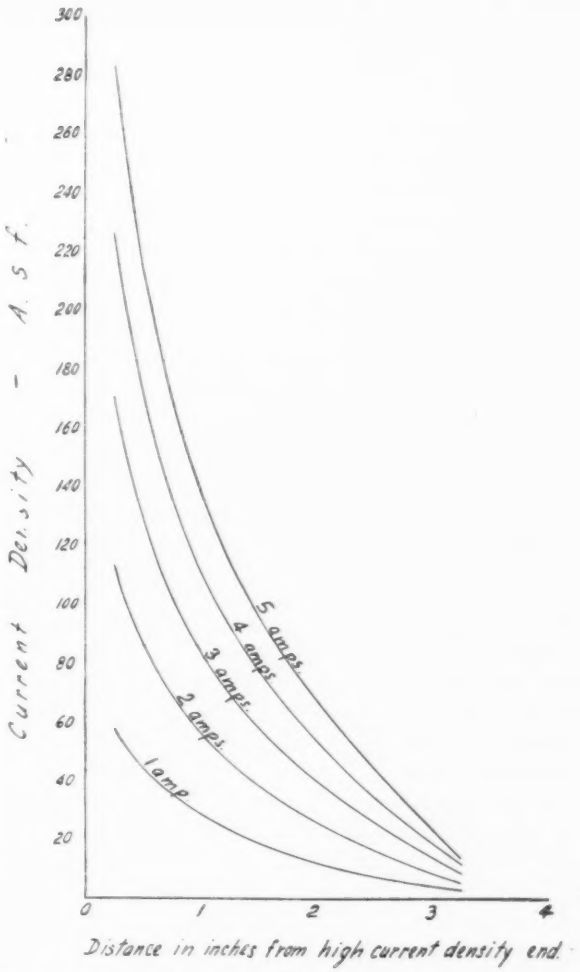


Figure 2. Current density for Hull cell plates. For total currents of 1-5 amperes.

The usual course of procedure followed in this part of the work was to run a Hull cell test at the desired solution composition, temperature, and pH and then follow with tests using the cylindrical specimen apparatus at definite cathode current densities. As previously mentioned, some tests with rotating cathodes were also conducted. Particular attention was given to those values of current densities which the Hull cell tests had indicated as being the limiting values. Further comments on this will be made later in the account of and discussion on the individual tests. At that time an attempt will also be made to correlate the results of the two different types of tests, namely Hull cell plates vs. the cylindrical cathodes. Recently Swalheim showed that a similar correlation was possible between Hull cell test results and those he obtained with his so-called duPont rotating cathode cell designed to evaluate conditions obtaining in strip plating.

The Sargent-Slomin Electrolyzer is an apparatus used normally for analytical work involving the determination of metallic constituents electrolytically and it was so employed for some of the present investigation into chemical control methods.

It also became apparent that the apparatus could be quite easily adapted to investigations into the electrolytic purification or "dummying" of plating solutions. It is essentially an apparatus for electrolyzing a solution with a stationary platinum mesh cathode inside of

which a smaller platinum mesh anode rotates. A D.C. current supply with controls and meters and a means of heating the solutions under test are also part of the equipment. For the work on purification of the fluoborate solutions, the apparatus was rewired so that the rotating electrode could be used as cathode and an additional rheostat and narrow-range milliammeter were connected to provide the low currents required for this application. It might be added that the apparatus so modified has since been used for similar studies and control of several commercial plating baths.

For investigating the throwing power of the fluoborate solutions and comparing it quantitatively with those of the two commercial solutions, a Haring cell[21] was used. The details of construction and use of the particular cell employed will be covered in a later section.

Bent cathode tests were also made on the three types of solutions. This test is a much simpler one and is used to determine the relative covering power and will also give a qualitative measure of the throwing power of solutions. The distinction between these two terms is that covering power denotes merely the ability to cover completely whereas throwing power is a measure of ability to cover all parts of the cathode with a deposit of uniform thickness. Mankowich has recently described the above two tests in a very complete and authoritative manner.

It was decided to use a commercial color comparator with its various indicator slide sets. This gave readings that were reproducible and presumably accurate to one-tenth colorimetric pH unit with several indicators except meta-cresol purple. Unfortunately this is the only indicator available in its range in the set used and, since the range it represents is important in the investigation of nickel fluoborate solutions, other means of determining the pH should be investigated. It is intended to do this in future work on the fluoborates.

It was determined that a preliminary clay treatment or electrolyzing the solution at a low current density, was not necessary. However, it later developed that a carbon treatment was beneficial and all baths were so treated.

The nickel fluoborate concentrate as supplied is of "purified" grade — that is, it has been subjected to a carbon purification prior to shipment. Presumably it should be ready for plating after proper dilution and addition of any other ingredients provided the latter are of suitable purity.

Plating Tests

Two main series of plating tests were run on each solution formulation, one using the Hull Cell, the other with the cylindrical cathodes. Additions of nickel fluoborate concentrate were made when required to maintain the metallic nickel content substantially constant as determined by analysis or specific gravity control. Adjustments in pH were made by addition of fluoboric acid or treatment with nickel carbonate followed by filtration.

Low Concentration Bath

The first solution investigated was prepared according to the low strength formulation. It contained about

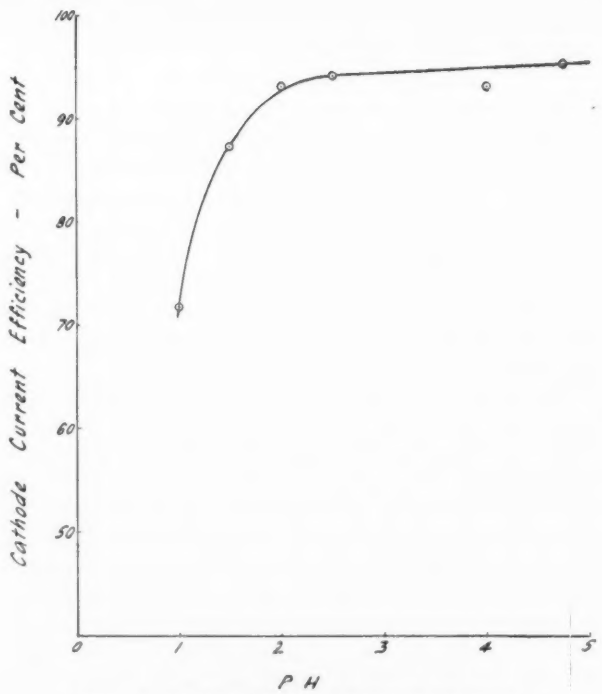


Figure 3. Cathode efficiency at various pH values.
Nickel fluoborate solution A-A-1
Ni content = 60 g./l.
Temperature = 55°C.
Current density = 20 a.s.f.

60 g./l. Ni, including 15 g./l. $NiCl_2 \cdot 6H_2O$ and also about 20 g./l. H_3BO_3. The latter amount is that due to the free boric acid content of the nickel fluoborate concentrate. Larger proportions of boric acid were also used.

The pH as prepared was 2.5 and the range from 1.0 to 4.75 was investigated. Temperatures from 45-65°C. were covered. In the Hull cell tests cathode current densities up to 400 amp./sq. ft. were included but the cylindrical cathode tests were limited to the range from 10 to 100 amp./sq. ft.

Considerable difficulty from pitting developed and the bulk of the tests in this series were run at a relatively low current density and other conditions varied to determine the effect on this tendency to pit. A current density of 20 amp./sq. ft. was used in most of the cylindrical specimen tests and a total current of 2 amperes for the majority of Hull cell tests. Treatments with hydrogen peroxide or with activated carbon and clay proved generally ineffective in controlling the pitting.

The effect of pH on cathode efficiency was determined at one temperature — 55°C. — and this data has been plotted in Fig. 3. It is seen that the efficiency drops off very rapidly below a pH of about 2.0.

In order to determine limiting current densities, Hull cell plates were run at relatively high total currents as previously explained. The curves are given in Fig. 4. On this chart similar data for other metal concentrations is presented and it is noted that the limiting current density in all cases increases in straightline relationship with the temperature.

The following other observations were noted from a study of the data.

a. Increasing the boric acid concentrations had no appreciable effect.

b. Lowering the current density from 20 amp./sq. ft. to 10 amp./sq. ft. noticeably decreased the cathode efficiency and increasing it from 20 to 100 amp./sq. ft. materially increased it.
c. The tendency to pit increased with pH and was particularly bad in the trial run within the range 4.0-4.75.
d. Plating immediately after addition of hydrogen peroxide resulted in extreme pitting and lowering of cathode efficiency.
e. There was no appreciable difference in results between copper, brass or steel cathodes.
f. There was little difference in tendency to pit within the temperature range of 45-65°C.

It is estimated that the average anode current efficiency was about 90%. That the anode efficiency was somewhat less than the cathode efficiency is borne out by the fact that the pH decreased to a small extent while operating.

High Concentration Bath

These solutions were prepared according to the suggested high strength formulation. The nickel content was twice that of the dilute bath, about 120 g./l. One set of solutions contained 15 g./l. $NiCl_2 \cdot 6H_2O$ similarly to the dilute bath whereas the others contained no Cl. Since twice the amount of nickel fluoborate concentrate was used, the free boric acid content is doubled, amount to about 50 g./l.

The pH of both solutions as prepared was 2.4 and tests were made with pH values of between 2.0 and 5.0. Temperatures from 25-65°C. were used. Hull cell tests were run to show effects of high current densities up to 300 amp./sq. ft.

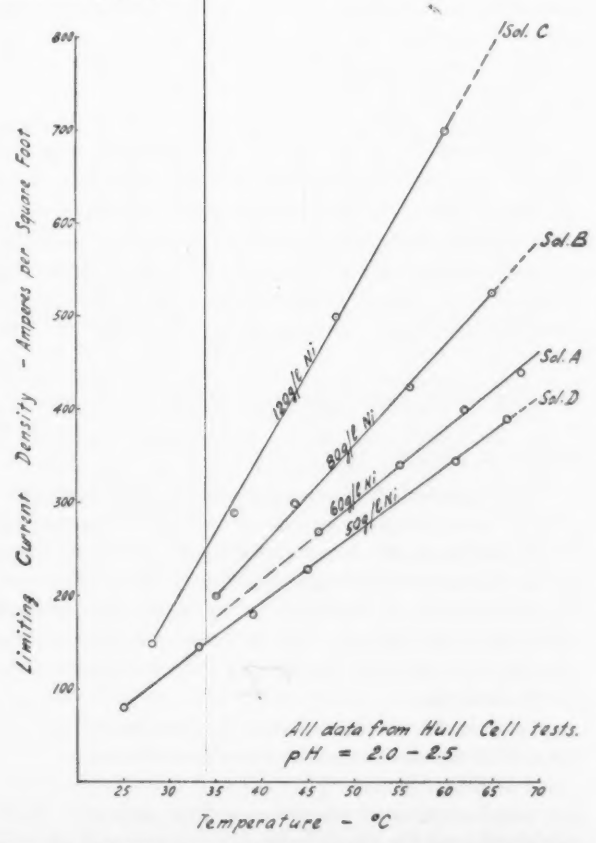


Figure 4. Limiting current densities at various temperatures for nickel fluoborate solutions at various metallic nickel concentrations.

Before commencing work with the chloride-containing solution, it was decided to increase the pH to about 5.0 at the start, thus making it possible to investigate the effect of lower pH values by merely adding fluoboric acid. This was accomplished by the addition of nickel carbonate. It was also decided to give this solution a preliminary purification with activated carbon and clay, and nickel content was adjusted to 120 g./l.

A cylindrical cathode test made in this solution at 55°C. and 20 amp./sq. ft. gave a dark, matte deposit with many small pits. Treatment was made with hydrogen peroxide. Another cylindrical cathode was then plated under the same conditions as before with practically identical results, that is, it was badly pitted. The cathode efficiencies were 98-99%.

At this point a Hull cell test was made during the course of which the electrode connections were inadvertently reversed so that the copper plate was the anode and a considerable amount of copper was introduced into the bath. Inasmuch as it had already been planned to investigate the removal of inorganic contaminants such as copper from the nickel fluoborate solutions it was decided to do this at this time with this solution. It was found possible to follow the progress of the purification quite well by means of Hull cell test plates. The final Hull cell test in this series gave a plate that indicated freedom from metallic impurities but some pitting was still evident.

Other tests made after purification indicated that a fairly bright deposit was obtainable at a pH of 5.0 and temperature of 55°C. when the cathode was rotating at speeds of 100-200 RPM (15 ft./min.) and current densities were in the range of 20-50 amp./sq. ft. However, the deposit seemed to be stressed and rather brittle and the cathode efficiencies were rather low, of the order of about 85%. Further investigation of this seems warranted.

Tests run under comparable conditions on solutions with and without chloride show very similar results in the nature of the deposits, thus demonstrating that the presence of chloride has little, if any, effect at the cathode as far as determined by this series of tests. Indeed, it is to be expected that the primary effect of the Cl ion would be on the corrosion of the anode and this is confirmed by the finding of an appreciably lower anode efficiency when compared to that calculated for a solution containing chloride.

From the first several samples plated with the chloride-free solution at 55°C. pH 2.4 it was seen that pitting was again encountered. The following purification treatment was then used:

1. Heated to 70°C.
2. Added 0.6 g. each of carbon and filter-aid (equivalent to 2#/100 gal. each). Stirred intermittently for 15 minutes.
3. Allowed to stand overnight (16 hours) at about 25°C.
4. Stirred occasionally for 4 hours.
5. Added 0.3 ml. of 100-volume H_2O_2.
6. Maintained at 70°C. for 4 hours.
7. Allowed to stand 24 hours.
8. Filtered and added 0.3 ml. of 100-volume H_2O_2.
9. Maintained at 70°C. for 3 hours.
10. Maintained at 55°C. for 1 additional hour.

A cylindrical sample then plated at 55°C. and 20 amp./sq. ft. still showed a considerable number of pits and a relatively low current efficiency (83.5%).

After standing idle for 3 days, a set of samples plated at increasing current densities showed a decided tendency toward higher cathode efficiencies at the greater current densities. These data have been plotted as Figure 4. At the same time, the deposit acquired more of a sheen and a greater tendency to pit became evident at the higher current densities.

Pitting was not reduced with cylindrical cathodes rotating at 100, 200 and 500 R.P.M. In fact, it appeared to become worse with cathode rotation and current densities of 800-100 amp./sq. ft. At higher average current densities of 200-300 amp./sq. ft. and rotating cathodes the deposit became semi-bright at the top and bottom where local current densities were quite high, and pitting, although still present, was noticeably less.

The Hull cell tests on the chloride-free bath were primarily conducted to obtain data on limiting current densities as was done in the case of the dilute bath. The total currents applied were comparatively high and quite large increases in temperature were encountered with corresponding drops in voltage required during the test. The Hull cell was left out of the water bath while running these tests and more uniform results would undoubtedly be obtained (as far as temperature and voltage are concerned, at least) if a cooling medium were used. However, it is felt that these tests are useful for the purpose here intended and it is noted that the results, plotted as one of the curves of Fig. 4, do fall in line with the others. The equation given previously was used for calculating the few tests made at the higher values of current than those plotted and shown on Fig. 1.

While plating the series of tests in question, 106

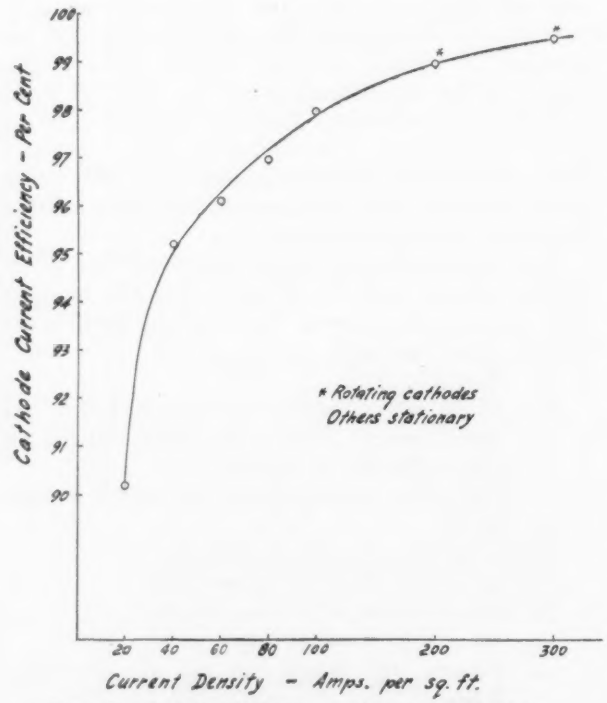


Figure 5. Cathode efficiency at various current densities. Nickel fluoborate solution C — Ni content = 120 g./l. Temperature = 55°C. — pH = 2.4.

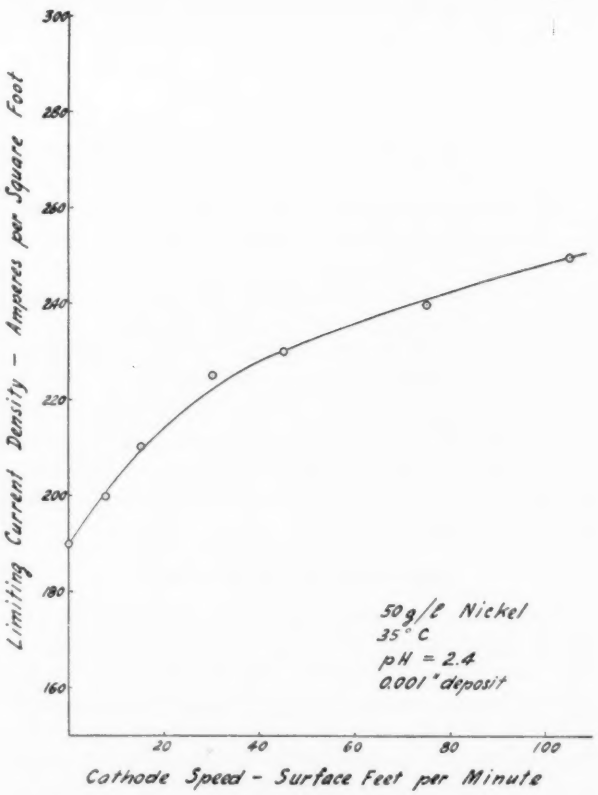


Figure 6. Limiting current densities at various cathode speeds. Nickel fluoborate solution D. Data from rotating cathode tests.

ampere minutes or 1.77 ampere hours of current were used. At 100% efficiency, 1.77 × 1.095 or 1.94 g. of nickel wuold have been dissolved. The average cathode efficiency during these tests was about 97% and at a similar average anode efficiency 0.97 × 1.94 or 1.88 grams of nickel should have been dissolved.

The specific gravity of the solution, at the same temperature (25°C.) and volume, changed from 1.300 to 1.2975. Since a change of 0.001 in the specific gravity of nickel fluoborate solutions at 25°C. is equivalent to a change of 0.355 gram per liter Ni, the loss in nickel content here amounted to (since 270 ml. volume was used) 0.27 × 2.5 × 0.355 = 0.24 gram. The amount actually dissolved was therefore 1.88-0.24 or 1.64 grams and the anode efficiency calculates out as $\frac{1.64}{1.94} \times 100 = 84.5\%$.

The calculated efficiency of about 85% for the chloride-free compared with one of about 90% for the dilute bath indicates a somewhat lower anode efficiency in the absence of chloride, bearing in mind, however, the limitations of accuracy in applying this method previously pointed out. The fact that the pH dropped somewhat faster with the former does corroborate the above finding.

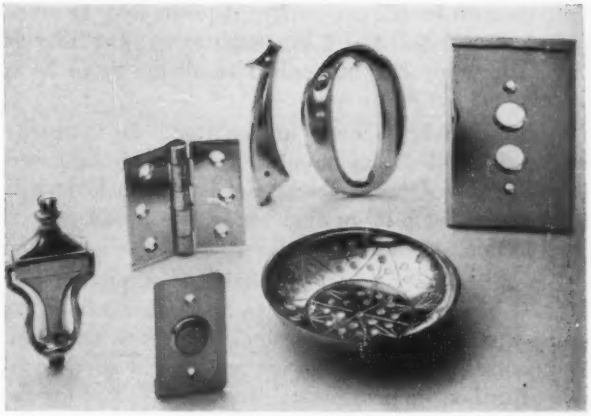
It should be mentioned that the two series of tests for which anode efficiencies have been estimated were made within the same pH range of 2.0-2.5. However, the metal content of the chloride-free bath was about double that of the dilute bath.

(*To be continued*)

BRONZE PLATING: WHY AND HOW

By Dr. Frederick A. Lowenheim,

Metal & Thermit Corp., Rahway, N. J.



(Courtesy Metal & Thermit Corporation)

Various parts plated by use of a bronze plating process.

RECENT, and apparently continuing, shortages in supply of nickel for electroplaters' use have stimulated efforts to find an acceptable substitute for the copper/nickel/chromium system. No development has so emphasized the fact that nickel has been the keystone of the plating arch as the dislocations caused by its relative scarcity. Most of the substitutes for, or alternatives to copper/nickel/chromium which have been offered to the plating trade have proved to be unsatisfactory in greater or less degree; and this situation has induced in the minds of many platers what seems to the present writer an attitude of unwarranted and dangerous fatalism. This attitude is in effect that, since no alternative is available, he will "get by" with whatever quantity of nickel he can coax from his supplier; and, if the quality of plated finishes has to suffer, why, so much the worse for the consuming public. While it is true that the nickel shortage has posed a very serious problem for producers of plated finishes, it is far from the case that nothing can be done about it. Finishing systems have been developed which extensive tests have shown to be excellent alternatives to the standard copper/nickel/chromium system, and undoubtedly superior to substandard copper/(nickel?)/chromium. Among the most promising of these developments has been the use of tin bronzes in place of all the copper and some of the nickel in the sequence.

Striking confirmation of the claims for bronze in this connection has come recently from an impartial investigation undertaken by an industry committee in England (which also suffers from a nickel shortage) known as the CODAF group (Co-Operative Development of Alternative Finishes). This group consisted entirely of platers and consumers — which should rule out undue influence by any supplier of proprietary processes or chemicals — and its findings have been widely reported in the British technical press[1] though, at the time of writing, no American journal has reprinted this report.

It is significant that the two best substitutes (or alternatives) for copper/nickel/chromium found by the CODAF group both involved bronze undercoats. First on the list was a 10-12% tin bronze followed by a special "high-temperature" chromium plate which was admittedly not entirely practical in operation; and right below this ranked the combination bronze/substandard nickel/chromium; if the bronze were about 0.001" thick the nickel might be limited to 0.0002" or less. The report concluded with a general statement on bronze as an undercoat that is worth quoting:

"The atmospheric exposure tests carried out by the Group have spotlighted the superiority in corrosion resistance of a 10-12% tin bronze deposit . . . as an undercoat in place of copper. Whether applied with or without a thin deposit of nickel between it and the chromium, the bronze is to be preferred to copper. This finding has been made also by the British Non-Ferrous Metals Research Association."

No such comprehensive testing program has been carried out in America, at least for publication. Tests of outdoor exposure and salt spray resistance are in progress at several laboratories, including those of the author's company, but are not yet sufficiently advanced to warrant publication in detail. What can be said at present is that bronze appears definitely superior to copper under chromium. There is little reason to doubt that the results will follow the same general trend as the British findings.

Bronze has other attractive features in addition to corrosion resistance. It is harder than copper, does not cut through so easily during buffing and has less tendency to drag on the wheel. The greater hardness further makes it a more satisfactory undercoat for chromium or nickel/chromium from a metallurgical standpoint. Cost factors, also, are unattractive: although naturally somewhat more expensive than copper, the fact that, for good results, the tin content can be limited to only 10 or 12% keeps the cost at a figure which compares favorably with nickel plating.

Bronze may be plated fully bright, at only minor sacrifice in ductility; the bright plate may be chromed

directly, and it also has attractive features as a final coating when protected from tarnishing by a clear lacquer. It closely resembles gold in color.

The metallurgical properties of bronze have suggested its use in some engineering applications;[2] unlike some other alloy deposits, there is no upper thickness limitation on bronze deposition: deposits may be made as thick as required by the application. Ductility is good; the alloy can be applied to all the usual basis metals.

Although overshadowed in importance by the many applications above mentioned, the oldest established use of bronze deposits should not be overlooked; it is the preferred stop-off in nitriding of steel, and has been used in this way for many years.[3]

Several processes are available for plating the 10-12% tin bronzes;[4] the one to be discussed here has many attractive features, including ease of operation and control, excellent throwing power, and good economy. Further, no proprietary salts are involved for the matte deposition process, and only the brightener for the bright plating method.

It may be well to interpolate here the remark that not all "bronze" plating processes deal with true bronzes: that is, alloys of copper and tin. Many so-called bronzes are really brass (copper-zinc alloys) masquerading under the higher-sounding name. We are concerned here only with true bronze.

The Bronze Plating Process

The process for plating 10% tin bronze to be described here grew out of some work done by the author in an effort to improve the "Speculum" process developed by the Tin Research Institute.[5] In the belief that the principal drawback of that process was the necessity for a dual anode circuit, efforts were made to circumvent this difficulty, and a method developed based on the use of copper anodes only, all the tin and some of the copper being provided by regular additions of copper stannate.[6] This expedient has several advantages: (1) the dual anode circuit was avoided, as aimed at; (2) it avoided the gradual buildup in free alkali which would be entailed in additions of alkali stannate; (3) copper stannate can be made and sold at a price which would eliminate the usual objection to chemical replenishment, namely high cost.

A practical large-scale test of this development was never made, however because, in America, the Speculum deposit did not gain acceptance in the trade — just why has never been satisfactorily explained. When the alloy of lower tin content — red bronze — showed promise, it was found very simple to adapt the method to deposit this alloy and, after appropriate modifications in formulation, some improvements in operating features and the development of a brightener, the present process was ready for commercial exploitation. Like the modified Speculum process, it is based on the use of copper anodes, with chemical replenishment as the source of tin. Practical experience has shown that, when the tin content of the deposit is only 10-12%, as here, even the copper stannate is often unnecessary and potassium stannate may be used as the scheduled addition. The expected rise in free alkali does not take place because carbonate formation which, incidentally, is of no practical consequence in bath operation, and drag-out are usually sufficient to keep the bath in balance.

The bronze plating solution is a cyanide-stannate bath of the following composition:

Potassium cyanide [KCN]	8.6 oz./gal.
Copper cyanide [CuCN]	3.8 "
Potassium hydroxide [KOH]	1.4 "
Potassium stannate [$K_2Sn(OH)_6$]	4.7 "
Rochelle salt [$KNaC_4H_4O_6{\cdot}4H_2O$]	6.0 "

Dissolving these salts in the order given, a solution of the following analysis results. The approximate control limits for each constituent are also shown.

	Make-up	*Limits*
Tin	1.8 oz./gal.	1.6-2.0 oz./gal.
Copper	2.7 "	2.5-2.9 "
Free KCN	2.9 "	2.7-3.0 "
Free KOH	1.3 "	1.2-1.4 "
Rochelle Salt	6.0 "	5.4-6.7 "

Average operating conditions are: temperature 155 ± 5°F., cathode current density 20-100 and anode current density 20-30 amp./ft.^{2}. Anodes are copper, with up to 20% of the anode area consisting of a chemically inert material such as graphite (bagged) or stainless steel. The tin content of the bath is replenished by additions of either copper stannate or potassium stannate.

Control is simple: free KCN and free KOH are determined frequently by standard methods and, if necessary, adjusted to proper range. Proper metal balance is then indicated by the color of the deposit. Except for purposes of color-matching, the exact control of deposit composition is usually not necessary, since chemical and physical properties of the bronze are not particularly sensitive to small changes in its composition.

For still tank plating a 6-volt source of DC is sufficient; barrel plating is quite practical, with DC at 12 volts or so. Tanks may be of plain steel. Cleaning and preparation of the work for plating are conventional.

Cathode current efficiency is of the order of 80%, decreasing gradually as the current density increases; but it remains useably high at cd's of 100 amp./ft.^{2} or above. Deposition rate at 30 amp./ft.^{2} is about 0.0005" in 17 minutes; at 100 amp./ft.^{2} this thickness of deposit may be applied in 7 to 8 minutes. Throwing power and covering power of the bath are excellent.

A brightener is available, the addition of which affords a fully bright plate, suitable for further finishing without buffing — with chromium or nickel/chromium — or as a final finish if protected from tarnishing by a clear lacquer. The bright deposit is somewhat less ductile than the matte but, for most applications outside the engineering field, the loss in ductility is not serious.

The description of the process given above outlines the principal features but is not intended as a detailed working instruction; complete instructions as well as methods of analysis are available.[7]

Summary

The process of bronze plating as outlined is well on

(*Concluded on page* 58)

The Slot Cell

By J. B. Mohler, *Consultant, New Castle, Pa.*

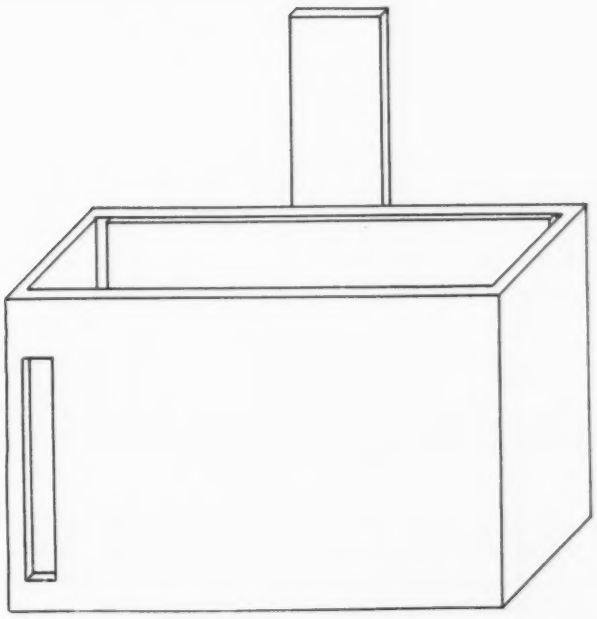


Figure 1. Slot type plating range cell.

Plating Tests

PLATING tests are undoubtedly as old as plating itself, as it has always been necessary to use such methods to develop a plating bath. Chances are also good that such tests were standardized for purposes of comparison. However, it is only in recent years that standard tests have been consistently used. The bent cathode test[1] has been used effectively in many cases to study bath variables. Laboratory personnel have held a preference for such a test where they desired to plate on horizontal and vertical surfaces or in a corner. The inclined cathode or the Hull test[2] is widely used and many modifications of this plating cell are commercially available. The Slot test[3] has also been used for experimentation and control for a number of years. A triangular plating cell[4,5] has recently been announced that features plating of both sides of the cathode and screening of its edges. Experimentation will undoubtedly continue with new arrangements and modifications of established cells, such as the work of Bertorelle[5] and Rousselot.[6]

The slot cell can be modified in a number of different ways[7] and such modifications have proven to be useful for various applications. Also the basic theory, applications, and calibrations have been given.[8] The most popular form at the present time is a four inch, dip type, Lucite cell with a single slot at one end, as shown in Fig. 1. Several modifications have been made in the cell. The slot has been raised off of the bottom of the cell ⅛ inch to produce a shadowing effect that results in more uniform current in a vertical direction. A recess 0.050″ deep has been cut in the back to allow a small amount of current to reach the back of the panel (Fig. 2). By keeping the panel ⅛ inch from the end, a reproducible reading can be obtained on the back in the low currently density area.

Testing Procedure

Testing with the slot cell is very simple. It merely consists of plating on a clean panel for five minutes. Cleaning, pickling, preplating, and rinsing of the panel can have an effect on the test. This has been demonstrated for chromium plating.[9] Nevertheless, good results are obtained for most baths by plating on a panel that is cleaned and acid dipped. Convenient zinc coated steel panels are available for simple and reproducible preparation. If these panels are used, the procedure is as follows:

1. Strip zinc in dilute acid
2. Rinse
3. Plate a definite area at a definite current and time
4. Rinse
5. Dry

Permanent records of test results are easily recorded by means of a simple sketch of a panel section.[10] Fig. 3 shows sketches of the front and the back of a test panel plated in a tin fluoborate bath. The high current density end is at the left in each case and the panel sections are shown below the sketch of each side of the panel.

Plating Standards

Plating tests are usually interpreted by comparison with a known plated standard. The original standard is often obtained by plating from a fresh bath or a bath that has been worked for a short time. For an old bath a standard can be established by adjusting the bath to the optimum chemical limits, treating by electrolysis, activated carbon and filtration, and adding addition agents until the widest plating range is obtained. This is a common, practical procedure. All that is required is a standardized testing procedure and a plating bath. The first panel that is plated then becomes a temporary standard. Any improvement in plating range brought about by purification, adjustment or additions then indicates bath corrections and also results in the establishment of a new standard. The advantage of such a procedure is that it can be put to work immediately.

Control of a plating bath, by means of a plating test, starts as soon as the first bath corrections are made as a result of interpreting the plating tests by direct comparison of one panel with another. Long range control starts when a record of a plating test is made for future reference. The direct comparison

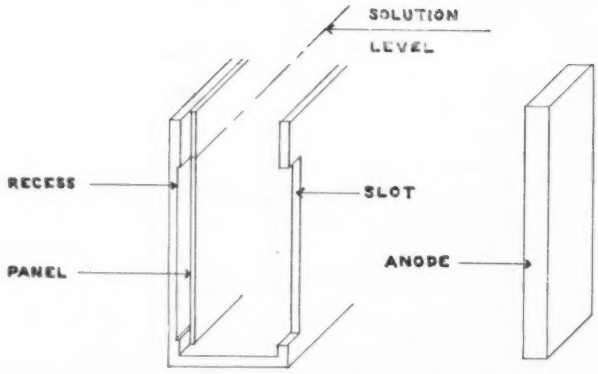


Figure 2. Section of cell with end removed to show the recess and the position of the panel to obtain a low current density range on the back of the panel.

method is good, but additional value can be gleaned from the test by reference to established standards.

Standards are of two types: current density standards and plating bath standards.

Plating Range Standards

Fig. 4 shows current density standards for the common plating baths. This is a simplified presentation from which the approximate limiting current density can be read. For a more accurate interpretation, it is necessary to determine a standard for each bath since the standard will change with the bath characteristics. After all, it is to be expected that the standard itself will shift with changes in polarization. On the other hand, these changes will not be great for a particular type of bath. All bright nickel baths will be approximately the same but, with the many types of nickel baths that are in use, it is not expected that one standard can be used for accurate interpretation of all. Different standards are also required for the high efficiency and low efficiency copper baths.

For control purposes the standards given are a good guide, since production plating is carried on at some safe current density below the limiting current density.

The key shown at the top of Fig. 4 is a sketch of a panel section. If this were a sketch for a panel plated at one ampere from a cold nickel bath, the average current density for two inches of immersion of the panel would be 20 amperes per square foot. The limiting current density would be 22 for bright plating and 52 for dull plating. If such a bath were used for nickel plating the sole plate of an electric iron at an average current density of 20, the appearance would be somewhat as shown in Fig. 5. By examination of the work, the areas where the current exceeds the bright and dull ranges are readily obvious. From the appearance of the work and from the plating range standard we obtain a visualization of the distribution of the current over the work. Apparently it would be necessary to reduce the total current to about one-third in order to avoid dull plating. Although it is helpful to estimate current distribution by this method, it soon becomes obvious that the limiting current density will be much higher than the operating current density.

From the plating range standard for nickel it can be seen that the ratio of maximum current density to average current density is about 4½ to 1 on the panel. Work of irregular shape or with sharp edges would then have to be plated at about one-fifth of the limiting current density to avoid dark plating. It might be said that for irregular work nickel has a range factor of about 5.

Operating Current Density Standards

Standards for operating current density are shown in Fig. 6. These standards were estimated from the plating range standards and a range factor deduced from these. Using the same panel section and the standard for nickel of Fig. 6, the maximum operating current density would be 5. This is only an approximation but, for control purposes, it is more satisfactory to read the panel in terms of operating current density than in terms of limiting current density. It is interesting to see that the operating current density standards are much more alike than the plating range standards. This is merely an indication that baths with high throwing power can be operated at an average current density that is a larger fraction of the value for the maximum current density on the work than for

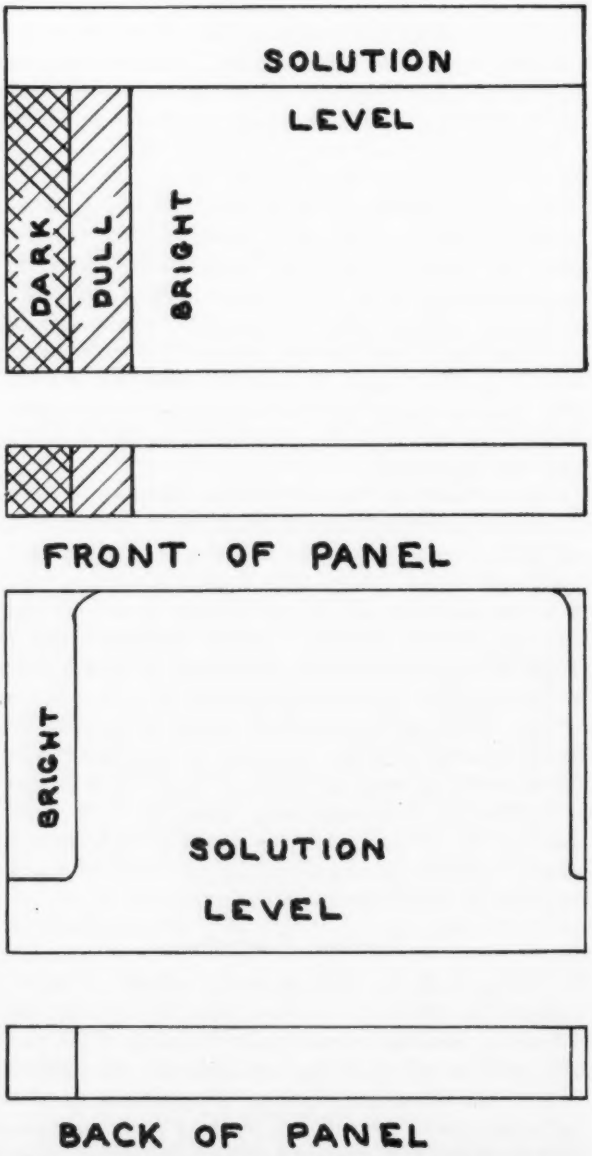


Figure 3. Appearance of front and back of a panel plated in a tin fluoborate bath and illustrations of sketches of panel sections.

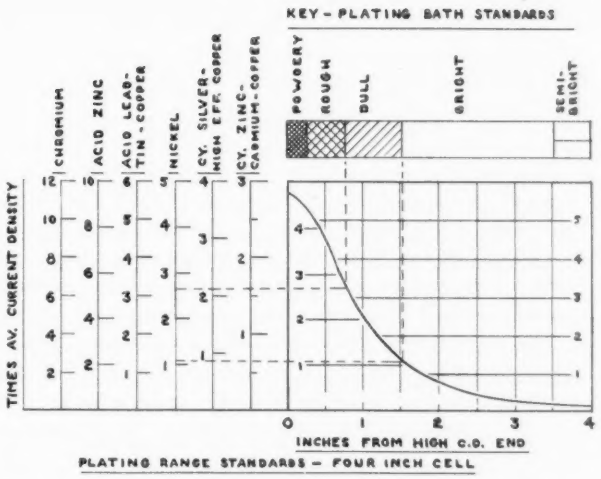


Figure 4. Calibration for the common baths used to estimate limiting current density.

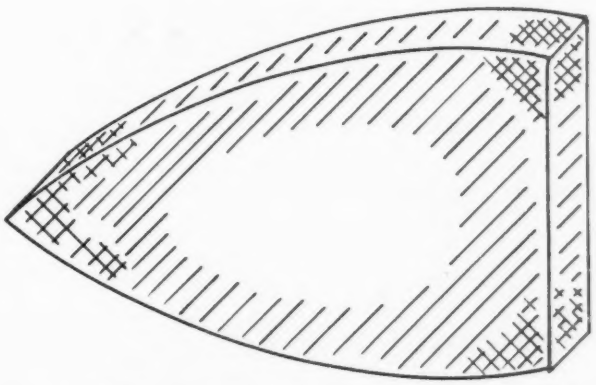


Figure 5. Appearance of the sole plate of an electric iron plated with nickel at an excessive total current.

baths of low throwing power. This, of course, is well known, but it also can be seen that, for the same total plating test current, approximately the same operating current density can be used for a limiting current line of the same position on the test panel.

Plating Bath Standards

Plating bath standards for the common baths are shown in Fig. 7. These are typical and can be used as a basis of comparison. The testing currents shown are normally used in the temperature ranges given. For reproducible results, it is best to control the plated area and the temperature, since these variables will have a marked effect on many of the baths. Some other testing current may be used, depending on whether the interest is in the high or low current density area. In general, a total current is used that will give a limiting current density line at ½ to 1 inch from the high current density end of the panel.

It is readily seen that there is a marked difference from one type of bath to another. Thus, cadmium can be plated at roughly three times the current density for brass.

The line on the panel for the chromium plating bath measures the minimum current density. To the left of this line the deposit is bright and to the right there is no deposit. Tests with chromium baths have shown that the minimum current density is greatly influenced by temperature. The method of preparing the panel is also critical. If the test is used for addition agent control, consistent results can be obtained by plating on a freshly nickel plated panel and by controlling the temperature within 1°C. The test may also be used for measuring the effects of surface preparation prior to plating.[9]

There is a noticeable difference between a rochelle and high efficiency copper cyanide bath. The difference is due in part to temperature, metal content, and free cyanide, and the test will indicate differences in each of these variables.

Differences in the nickel baths are also very noticeable. The bright nickel baths have a very high limiting current density as compared to a cold nickel bath.

For the alkaline tin and bright zinc cyanide baths the entire panel is bright at a relatively high testing current.

The Slot Cell

The standards shown are for a slot cell four inches long and one inch wide with a ¼ inch slot. This is a convenient size for general work. Multiples or fractions of these dimensions can be used and the same standards will apply in terms of cell dimensions. In other words, the cell is dimensionless, so that other sizes may be used if desired.

The features of plating through a slot is a distinct advantage in that it removes the effect of the anode on the test results. Also, it is an advantage to be able to immerse the cell in a beaker or a bath, since this simplifies the problem of control of bath temperature. Any convenient volume of solution may be tested, be-

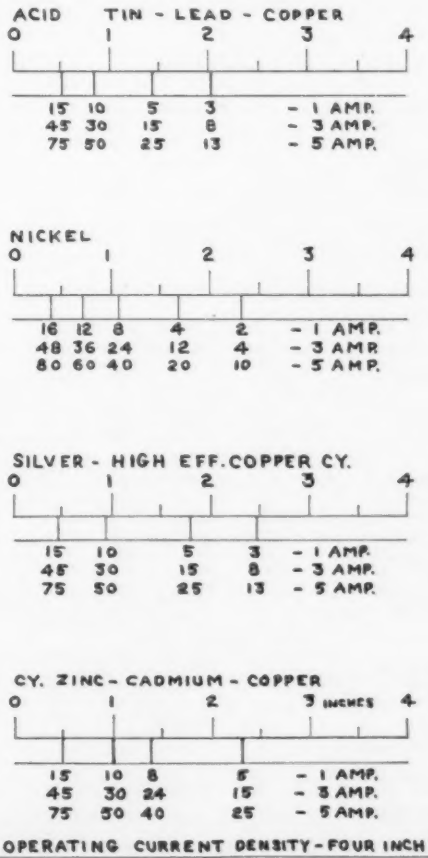

ACID TIN - LEAD - COPPER
0 1 2 3 4
15 10 5 3 - 1 AMP.
45 30 15 8 - 3 AMP.
75 50 25 13 - 5 AMP.
NICKEL
0 1 2 3 4
16 12 8 4 2 - 1 AMP.
48 36 24 12 4 - 3 AMP.
80 60 40 20 10 - 5 AMP.
SILVER - HIGH EFF. COPPER CY.
0 1 2 3 4
15 10 5 3 - 1 AMP.
45 30 15 8 - 3 AMP.
75 50 25 13 - 5 AMP.
CY. ZINC - CADMIUM - COPPER
0 1 2 3 INCHES 4
15 10 8 5 - 1 AMP.
45 30 24 15 - 3 AMP.
75 50 40 25 - 5 AMP.
MAXIMUM OPERATING CURRENT DENSITY - FOUR INCH CELL

Figure 6. Charts for estimating the operating current density of the common baths for plating on irregular objects.

cause this is a matter of the size of the container rather than the size of the cell.

Plating Control Practice

In large plating installations, where it is vital to keep equipment operating, it is not uncommon to use more control methods than necessary just to be sure, or possibly as a double-check. One more inexpensive method will have an almost immeasureable effect on the cost. In very small plating operations, particularly where the plater controls his own bath, no tests or analyses at all may be made, except for occasional analyses by an outside laboratory. In other cases, plating tests are used as a substitute for chemical analyses for such ingredients as metal content and free cyanide. Within, and including these extreme methods of control, the plating test satisfies a distinct need.

Control of a plating bath without the benefit of chemical analyses can only be recommended in an extreme case. On the other hand, control by means of or with the aid of plating tests cannot always be recommended. However, in many cases, control by means of chemical analyses and other tests, supplemented by a plating test, has been the most economic answer.

Common examples of the effects of bath variables on a plating test have previously been given.[10] The general effects are shown in Table 1. In the well controlled bath the plating test is not depended on for metal content, free cyanide, or acid content. However, these variables definitely effect the test and a routine plating test may reveal an unexpected change in the bath before it is possible to obtain a chemical analysis.

Possibly the best use of a plating test is that it serves as an overall check on a bath. One test will check for addition agents, impurities, organic contamination, dirt and any major variable that is out of limits.

Figure 7. Plating bath standards for the common baths and a four inch slot cell.

Addition Agent Control

The variable that is best controlled by plating test is usually that of the addition agents. The bright baths and many of the acid baths are dependent on such a means of control. There are many examples of specific baths controlled by this method. However, they usually follow a typical testing pattern, as demonstrated in Fig. 8. The top panel section represents a fresh bath before any addition agent has been added. At 50% of the optimum the plating range has been greatly increased. The next panel at 100% is, of course, the optimum. An excess of addition agent beyond this point, even

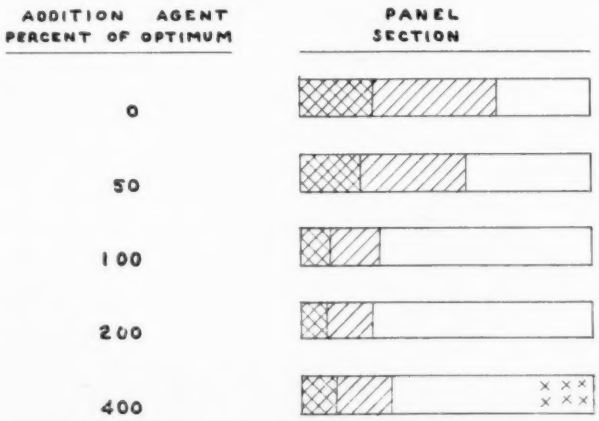


Figure 8. A series of panel sections showing the effect of increasing amounts of addition agent.

up to 4 or 5 times the optimum, may increase the plating range even more and usually does. However, if this increase is small it is not recommended, since excess addition agent will often cause trouble as the bath ages. Therefore, the optimum concentration is not that which will cause the maximum limiting current density, but rather that point beyond which there is very little change for a substantial addition. An excess of addition agent will often show up as brittleness or cracks in the low current density area, as indicated on the bottom sketch. In the case of a lead fluoborate bath, an excess of gelatin may be added with no apparent bad effect. However, after several days of use with excess gelatin, vertical lines will appear on the work and on the test panel near the limiting current density area.

If two or more addition agents are used, one is adjusted to the optimum and then another is adjusted. It is often worthwhile to check separately at ½ the apparent optimum for one and optimum for the other, and then the reverse. This is done to determine if less addition agent can be used than indicated by the first tests. If one of the addition agents can be determined by surface tension or analysis it is best to adjust this one by such testing and the other or others by plating test. In general, it is the colloidal addition agents that are adjusted by plating test, since analyses are often meaningless for application of such compounds to plating baths.

Impurities

Excess addition agent or organic impurities may cause brittleness to such an extent that the deposit will crack. These cracks usually show up in the bright range. Stop-off lacquers that are slightly soluble in the bath can cause this trouble. Treatment with activated carbon, followed by filtration, will usually remove troublesome colloidal impurities. At the same time the colloidal addition agents will be removed. A plating test followed by carbon treatment, filtration and then adjustment by plating test will serve as a guide for treatment of the bath.

A spotty deposit may indicate that oil in the bath is causing trouble. If spots show, the bath should be examined for oil. The oil may be removed by allowing it to collect on the surface and skimming it off.

Metal impurities that are more noble than the metal being deposited will usually show up as a dark deposit in the low current density area. They may be removed by treatment of the bath with powdered metal followed by filtration, by low current density electrolysis, or by chemical means where methods are known.

Dirt or any suspended matter in the bath can cause a rough plate. If this is suspected, filtration followed

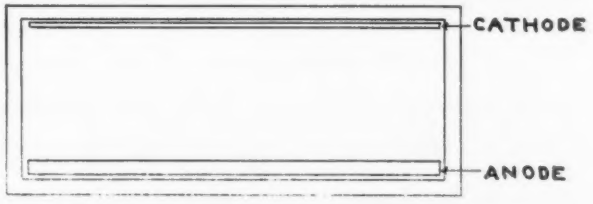


Figure 9. Narrow cell to obtain uniform current over the cathode and to determine the treatment time and current for low current density electrolysis.

by a plating test may reveal the cause. A five minute plating test may not reveal this. Sometimes it is better to plate for several hours on a small flat piece of steel hung between anodes. The trouble shows up more readily on a heavy deposit. If this is the trouble, the deposit will be rough but solid. A powdery or treed deposit that shows up on a plating test is generally due to some other cause.

Small anode particles may be charged and attracted to the cathode. The anode metal, or metals immersion plated on the anode, can cause this trouble. This trouble can show up on a slot test but may be revealed more readily by plating on a specimen for a longer time as for the case of dirt. The trouble is corrected by cleaning the anodes and the tank and by filtering the bath.

Occasionally a plating test will reveal trouble and the exact cause cannot easily be determined. Treatment with activated carbon followed by filtration and adjustment may correct the trouble. If it does not, it is probably due to soluble impurities. These may often be removed by electrolysis. A procedure commonly used for nickel baths is to electrolyze at a current density of 5 amp./sq. ft. until a plating test reveals that the bath is plating normally. If a long narrow cell is used, as in Fig. 9, then the test may be done in a short period of time. Ten minutes of plating in a narrow cell may clear up the trouble. From the current density and the amperes per gallon the treatment time can then be calculated for the production bath.

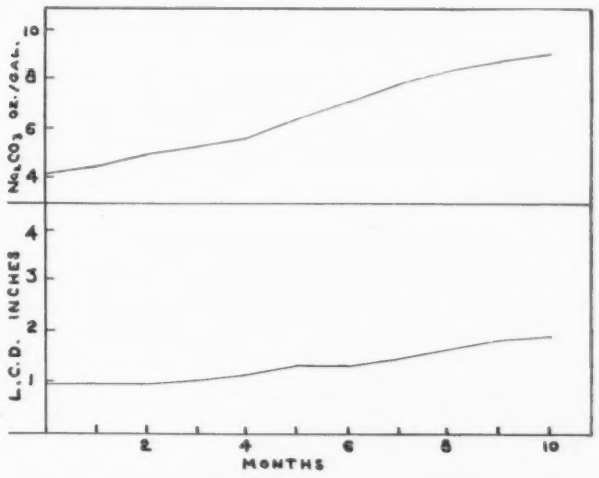


Figure 10. Decrease in limiting current density with time due to build-up of carbonate in cyanide baths.

The back of the panel, as shown in Fig. 3, can often be read for addition agent control. Some addition agents show an optimum concentration by extending the covering power or the ability to plate at low current densities. For such a case there may be very little change on the front of the panel, but a definite change on the back.

Many platers feel that valuable information can be obtained from a plating test if the solution is agitated during the test. This is often done when the plating test is applied to an agitated bath.

If a bath is agitated, the limiting current density will be increased. For instance, by the use of cathode rod agitation of 5 feet per minute, the plating rate for a plain silver bath can be increased from 5 to 12 amp./sq. ft. Agitation during a test will not only increase the limiting current density, but will also change the standard. More experience with this type of testing is desirable.

Agitation can be used during the slot test in several ways. Manual agitation with a stirring rod can be used or the solution can be pumped into the end of the cell and be allowed to run out the slot. Agitation can also

TABLE 1

General Effects in Acid and Alkaline Baths

Increase In	*Due To*
Powdery Plate	Low metal, low free cyanide, low acid, impurities, low addition agent.
Rough Plate	Low metal, low free cyanide, low acid, dirt in bath, low addition agent.
Streaks	Impurities, excess addition agent.
Blisters	Impurities, oil or air in bath.
Cracks	Excess addition agent, impurities.
Excessive Brightness	Excess addition agent, impurities, excess metal in bright cyanide baths.

be applied by changing the cell design. Experiments are in progress along these lines.

For general testing and control, bath troubles can be diagnosed by the use of standard testing procedures, even though agitation is used on the production bath. Of course, the standards for operating current density will not apply.

Changing the Bath Limits

At times it is desirable to change the limits of a standard bath. Characteristics of a bath, such as nickel, can be readily changed by changing the formula. The limiting current density can be increased by increasing the metal content; better anode corrosion can be obtained by increasing the chloride content and decreasing the pH. Corrosion of zinc or aluminum to be plated can be decreased by increasing the pH. Such changes cannot be made indiscriminately. Many arbitrary changes will result in a narrow plating range. However, with the aid of a slot test, compensating changes can be determined to successfully alter the bath. In particular, bath temperature can be explored. A changed bath with a narrow plating range may be converted to a bath with a wide plating range by increasing the temperature. This can easily be determined by means of a plating test.

Copper cyanide baths are also critical as to composition. Anode polarization and plating rate are readily effected both by free cyanide and temperature. If it is desired to develop a bath that is a compromise of striking qualities, anode polarization, and plating rate, slot testing can be used as a guide.

Good records of test results are helpful for long range testing. Sketches of the panel section or records in terms of inches from the end of the panel will reveal gradual changes in a bath.

Impurities may slowly build up in a bath with a resulting shift in the plating range that is not obvious in the absence of long range records. In fact, impurities may slowly be removed and cause either a gain or loss of limiting current density.

Build-up of carbonate in a cyanide bath commonly causes a slow shift of the plating range. Although it is not common, it is sometimes possible to restore the original limiting current density by changing the bath limits of an old bath. This is to say that the limits for an old bath will be different than those for a fresh bath. Fig. 10 shows a drift that can be revealed by plotting the plating test against time for cyanide baths. It is possible that pH may help to correct this loss. In fact, it is known that there is less change in some of the silver cyanide baths where potassium hydroxide is used to control the pH.

Where correction due to drift is a possibility, slot testing will reveal corrective measures.

For any plating bath it is desirable to establish control methods and tests for each important controllable variable. In order to do this, it is not only necessary to standardize on a specific bath but also on a particular application. With all the variations of the common baths plus applications of decorative, engineering and flash plating, plus various impurities entering the bath, definite recommendations are difficult. It is better to operate on general principles with the use of established standards and determine specific control procedures for each particular application.

References

1. W. Pinner and E. M. Baker, Trans. Electrochem. Soc., **55**, 315 (1929).
2. R. O. Hull, Amer. Electroplaters' Soc., Proceedings (1943).
3. J. B. Mohler and R. A. Schaefer, The Monthly Review, 1363 (Dec. 1947).
4. Metal Finishing, **52**, 76 (1954).
5. E. Bertorelle, Metalloberflaeche, **6**, No. 1, pp. B2 to B5.
6. R. H. Rousselot; Annual Conference on Hard Chromium, May 1954, Paris, France.
7. Metal Finishing, **46**, 59 (1948).
8. Metal Industry, **83**, 219 (Sept. 11, 1953).
9. W. M. Tucker and R. L. Flint, Metal Finishing, **44**, 340 (1946).
10. Metal Finishing, **45**, 59 (1947).

BRONZE PLATING: WHY AND HOW

(*Concluded from page* 52)

its way to the status of a thoroughly tested and proved industrial tool, definitely out of the beaker and pilot plant stages. Many installations of all sizes, from small still tanks and barrels up to large fully automatic machines, are in operation and a backlog of practical information is rapidly being built up. No unusual difficulties have been encountered and the usual starting-up headaches have been very few. Applications range from its use as an undercoat for chromium and nickel/chromium to decorative gold-like finishes on inexpensive jewelry items, escutcheon plates and the like.

The use of bronze (10% tin-copper alloy) as a partial or complete substitute for nickel and copper in the decorative-protective finishing system copper/nickel/chromium appears to be the most promising solution to the present shortage of nickel. The alloy has, in addition, attractions as a final finish, with its pleasing gold-like color. Engineering uses are also indicated.

The potassium stannate-copper cyanide bath described is economical, easy to control, and of favorable operating characteristics. It has proved entirely practical in plant operation.

References

1. Bull. Inst. Met. Finishing, **4**, 245 (1954-55); Electroplating, **8**, 9 (1955).
2. W. H. Safranek, W. J. Neill and D. E. Seelbach, Steel, 133, (No. 25), 102 (1953); K. Rose, Materials & Methods, **41**, 100 (Jan. 1955).
3. C. Struyk, Monthly Review AES, **33**, 394 (1946); E. S. Coe, Iron Age, p. 86 (June 14, 1951).
4. H. M. Batten and C. J. Welcome, to City Auto Stamping Co., U. S. Patents 1,970,548/9 (1934); C. Bechard, Comptes Rendus, p. 1737 (May 20, 1935); G. Schmerling, Electroplating, **5**, 115 (1952); W. H. Safranek and C. L. Faust, Plating, **41**, 1159 (1954).
5. R. M. Angles, F. E. Jones, J. W. Price and J. W. Cuthbertson, Jour. Electrodepos. Tech. Soc., **21**, 19 (1946).
6. F. A. Lowenheim, to Metal & Thermit Corp., U. S. Patent 2,528,601 (1950).
7. Metal & Thermit Corp., Technical Data Sheet No. 135 (1954).

Oil Derrick Marks Chromium Tank

By Fred A. Herr, *Pacific Coast Editor*

MOTORISTS driving east on Washington Blvd. in Los Angeles, Calif., frequently turn their heads in a startled gesture of surprise as they pass the corner of Hooper Street, when they see a towering oil derrick rising from amidst the factories of that highly industrialized section of the city.

But nobody is drilling for oil there. The derrick stands on a lot adjacent to the plant of *Superchrome Engineering Co.*, one of the larger Southern California firms specializing in hard chromium plating of difficult-to-handle metal finishing jobs.

The derrick not only looks like an oil rig, it is one; a converted derrick which saw duty in the Los Angeles Basin oil fields, and which was acquired by the company as a part of the expanded plating facilities which it recently installed.

The derrick rises above what is claimed to be the deepest commercial plating tank in the United States. The tank, on which construction was completed in February, represents the latest expansion move on the part of the firm which, since its founding a little more than four years ago, has risen to a dominant position in Southern California in pioneering hard chromium applications on tubing and rod used for drilling of water, natural gas, and petroleum in the states of California, Utah, Texas, and Oklahoma.

The plant is housed in an 8,000 square foot one-story building. It has special equipment designed and engineered specifically to hard chromium plate oil barrel tubes and core barrels, polish rods and pump plungers, aircraft flap tracks, diesel liners, molds, dies, and marine turbines. The items used in the oil industry are subjected to a great amount of abrasion and are chromium plated as a means of prolonging the life of the parts many times more than if they were used without first being plated.

45 ft. Deep Plating Tank

During recent months the company has expanded by the addition of a considerable amount of new equipment. The most interesting installation among the new facilities is the 45 foot deep hard chromium plating tank constructed on the lot east of the plating shop building. This tank supplements a 14-foot-deep hard chromium tank inside the building which Superchrome has had in operation several years.

The company was persuaded to install the outside

A spectacular sight in the East Side industrial district of Los Angeles, this 102 foot steel oil derrick was recently mounted above a new 45-foot-deep hard chromium tank.

tank in response to an ever increasing demand from manufacturers and distributors for longer lengths of hard chromium plated tubing and rod. The tank has a diameter of three feet and, according to the general manager, has been verified as the deepest commercial plating tank in the United States.

The actual construction consists of a 45 foot-long, 3/8 inch steel casing lined with 7,500 pounds of half-inch thick, 6 per cent antimony lead. It is set in a 43 foot deep pit lined with galvanized 12 gauge steel. The tank extends two feet above the surface of the ground. The mouth and its network of service piping and attached heating and cooling units is located centrally beneath the derrick in the same position occupied by the casing head and drill table of an actual oil field rig. It holds 2350 gallons of chromic acid solution. Power is supplied by a 10,000 ampere generator installed in a weatherproof housing in the open beside the tank.

102 ft. Steel Derrick

Above the tank rises a steel oil derrick 102 feet high and 20 feet square at the base. The derrick is mounted on concrete footings sunk six feet in the ground to meet city ordinance requirements. It serves the same purpose in the plating tank as does a derrick in an oil field — to hoist long objects so that they may conveniently be lowered into the well.

At the Superchróme Engineering plant, the lengthy oil and barrel tubes are lifted by the hoisting cables much like the casing of an oil well. A 38-foot tube, for instance, is drawn up into the rig and then lowered concentrically into the 45 foot tank. Then the floating anode mechanism is lowered into the I.D. of the tube to be plated, making sure concentricity is maintained.

The anodes are of antimonial lead, and are designed to give maximum anode area versus the equivalent cathode area which is being plated during the cycle. In addition to hoisting, another function of the derrick is to facilitate reciprocating action of the anodes during hard chromium plating operations. The 45-foot tank is regarded as foolproof since its design and engineering include automatic controls for temperature which maintain the solution at plus or minus 2°F., floating anode arrangement, circulation, and adjacent power distribution. While the tank at present is in the open lot, it is planned later to enclose the lower parts of the derrick with a weather-protecting housing.

43 ft. Tubes Plated

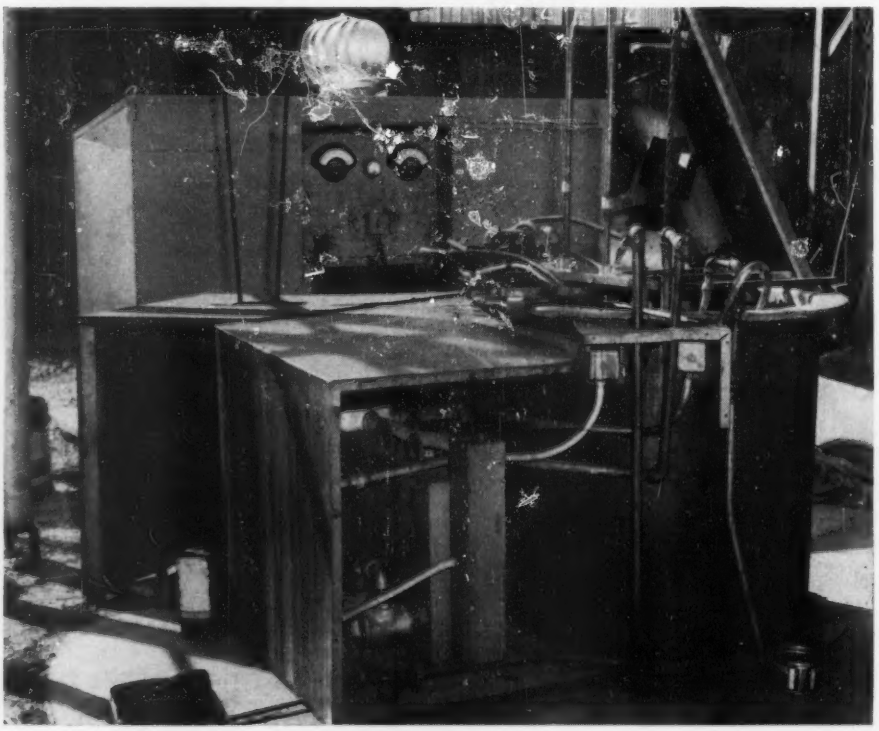
In this tank it is possible to hard chromium plate the inside diameter of core and oil barrel tubes up to 43 feet in length and with diameters up to six inches, to a deposit thickness of .006″ + .001″ or better. The company can also plate to .030″ on the outside of this same length up to 2½ feet in diameter. To date the longest piece plated in the tank has been a core barrel tube for an oil field equipment exporting firm in Salt Lake City, Utah, which measured 38 feet in length and had a diameter of 2¾ inches.

In addition to long pieces, such as oil field tubes, the company employs the deep tank for plating calendar rolls (used in the rubber, paper, steel, and other industries) in excess of eight tons in weight, as well as shafts, pistons and turbines of great size and weight. The company does much of such work to exacting government specifications, including high and low pressure turbines for ocean going vessels.

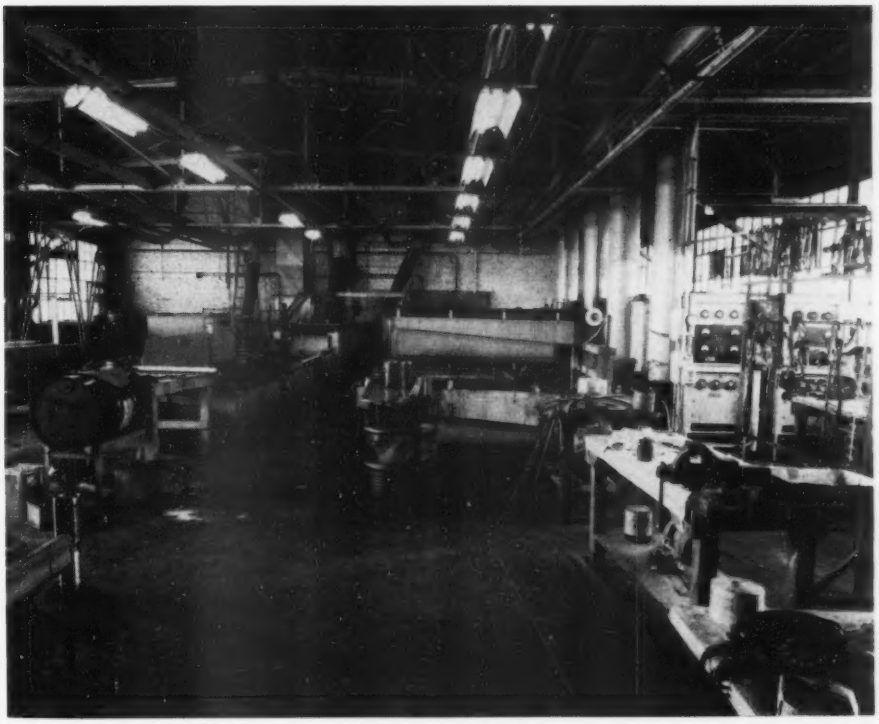
In full production, the company can plate 120 core and tube barrels a month. Time required on such jobs depends on thickness and specifications. Average time is 8 to 24 hours and the cost runs from $18.00 to $250.00, dependent upon the type and size of the item and thickness of deposit.

Chromium Plating Dept.

The inside facilities of the company are installed in a production department measuring 60x80 feet. Included are a hard chromium division, cadmium-copper division, polishing shop, hydrogen embrittlement relief oven, machine shop, inspection department, and laboratory-production control rooms.



Close-up of casinghead (right) of 45′ deep hard chromium tank of which 43′ are below surface and 2′ above. Visible in the open-front housing (foreground) is automatic heating and cooling mechanism. Far left is motor that actuates the cables with which anodes and tubes are hoisted and lowered. 10,000 amp. generator is shown in background. Tank holds 2350 gallons of chromic acid solution.



General view of interior of plating room showing (center-rear) eight hard chromium tanks used for plating aircraft flap tracks and the O.D. of oil well plungers.

The chromium division contains a 14-foot-deep tank, 4 feet square, which is used to hard chromium plate the inside and outside diameters of tubes, plungers and polishing rods up to 12 feet in length.

This tank is equipped to handle work weighing up to eight tons, and is used for plating shafts, rolls, pistons, etc. It is designed for conversion, as needed, into a 20 foot tank for handling parts up to 18 feet in length. To convert it, an extension cylinder is immersed into the underground 14-foot barrel, creating a tank within a tank. The unit is arranged to enable floating anodes to reciprocate. A pocket arrangement of anodes is used for hard chromium plating the O.D. of oil well plungers.

In order to facilitate hoisting of long items into the plating tank, as well as the floating anodes, an 18-foot tower has been erected above the tank on the roof of the building. This, including the 20-foot ceiling height, provides 38 feet of headway over the tank.

This tank has contributed considerably to the firm's reputation for "selective" plating. One of the difficult plating jobs involved a large diesel cylinder for the Navy. Specifications called for an oversized 27 inch bore to be chromium plated .015 on the I.D. The 67-inch long, 1½ ton part, containing 6,000 square inches to be plated, was successfully finished in the Superchrome shop in 100 hours.

The operators of the firm take pride in the fact that they have a reputation for coming up with the solution for difficult plating jobs that have been turned down by other shops. One such job involved a huge six ton, high-pressure turbine from the Navy requiring .040" of hard chromium on the O.D. of the bearing surface and carbon packing area. The turbine was so large that it could not be handled inside the shop. The problem was solved by building a rig on the lot outside the plant to plate the turbine. Power cables, chromic acid solution containers, water lines and other facilities were run outside the shop to the plating area set up on the lot. A rubber gasket was attached to the shoulder of the turbine to mask off areas to be plated. The job was handled to the Navy's satisfaction.

In addition to the 14-foot tank, the hard chromium department is equipped with six other tanks having a total capacity of 6500 gallons of chromic acid solution, fed by 26,000 amperes of direct current. One eight foot tank is used for hard chromium plating aircraft flap tracks and the O.D.'s of oil plungers.

The newest addition to the company's facilities is a cadmium and copper plating department. This equipment was originally installed for use in connection with the hard chromium plating work, but has been developed into an individually functioning profit-making department. The cadmium and copper plating installation consists of a 600 gallon cadmium tank, and a 300 gallon copper tank, plus auxiliary tanks.

In addition to the already mentioned tank capacity, the plant contains a completely equipped machine shop, including lathes, drills, electric saws and miscellaneous machinery. These are used in the fabrication of special floating anodes required for the large amount of inside diameter plating work that is performed in the shop. Special fixtures required in some of the out-of-the-ordinary plating jobs are also designed and manufactured in the machine shop.

The plant is equipped with a 6 x 10 foot oven for relieving hydrogen embrittlement. Many of the aircraft parts plated to military specifications are baked in the oven to relieve such embrittlement which invariably occurs when heavy deposits of hard chromium are involved. The oven is thermostatically controlled to within $\pm$ 2°F.

The shop is equipped with all required pre-plating facilities, including a degreaser and complete cleaning cycle equipment. It includes a reverse etch tank in which a fine etch is provided on the base metal to facilitate better adhesion of the chromium to the plating area.

The polishing section contains three automatic polishing lathes complete with automatic controls, belt polishers, and grinders. This section is equipped for prior polishing to secure the desired base metal micro

(*Concluded on page* 63)

Electroless Chromium

By Harry J. West, Ch.E., *Elkhart, Ind.*

AFTER considerable experimenting, the writer found that a satisfactory chromium deposit could be obtained by the "electroless" process, similar to that recently described for nickel. An acetate bath is preferred on steel while the non-acetate type is used for copper and brass, although a steel part must also be introduced along with the non-ferrous metal at the same time. The same procedure as in ordinary electroplating is used for cleaning, etc. in preparing for the deposition of electroless chromium.

A ductile gray chromium plate will be obtained which will not flake off when part is bent. Bright deposits can be obtained by simple rubbing of the plate with a cloth, by buffing, or by tumbling in sawdust.

The advantage of electroless chromium is, obviously the uniform coverage of deep recesses, corners, depth of holes and irregular shapes where internal anodes must be used for electrodeposition. One can now electroless chromium plate over and cover areas plated first with electroless nickel.

Rate of deposition is quite rapid and complete coverage of a part takes only about two minutes, with continuous buildup thereafter. The plate is quite ductile and a plated part can be bent double without cracking the deposit. At this time the writer has found the rate of deposition to be about 0.0001" per hour; however, it is believed a faster rate will be obtained with future experimenting.

Oxidation takes place rapidly when parts are removed from the bath, but the oxide can easily be removed and the true chromium color can be brought out with a minimum of buffing.

The writer has found in high temperature Lucite, a suitable material of construction for barrel chromium plating. As in the case of electroless nickel, a porcelain or glass-lined container is most desirable.

*Solution and Method**

SOLUTION COMPOSITION:

Type 1:

Sodium Citrate	32 grams
Sodium Hypophosphite	32 "
Chromium Fluoride	64 "
Chromium Chloride	4 "
Water	1 gallon
Temperature	160-190°F.

Type 2:

Sodium Citrate	32 grams
Sodium Hypophosphite	32 "
Chromium Fluoride	64 "
Chromium Chloride	4 "
Glacial Acetic Acid	40 cc.
20% Solution Sodium Hydroxide	40 "
Water	1 gallon
Temperature	160-190°F.

OPERATING DETAILS:

A catalytic initiation is necessary in order to operate an electroless chromium bath. In some cases, a less noble metal, such as iron or aluminum, must be brought into contact with a non-catalytic metal while it is immersed in the hot electroless solution. Once the process has started, it continues because of the catalytic action of the initial deposit.

A thin deposit of chromium is ductile but, as the thickness increases, the plate becomes harder. In salt spray tests on steel coated with 0.0002" of electroless chromium, in comparison with similar parts coated with electro-deposited chromium, the protective value of the two types of coatings was about the same.

In preparing the solution, about two-thirds of the required amount of water is heated to 150°F. and the chromium fluoride added. After making sure the CrF_3 has dissolved, the chromium chloride is added, followed by the sodium citrate and the sodium hypophosphite last. The balance of the water is finally added. All the chemicals dissolve very rapidly in hot water but care should be taken in handling the chromium fluoride because of its toxicity. The acetic acid and caustic soda are added last in Formula 2.

The initial make-up lasts up to eight hours of continuous plating with an addition of about 10 grams of sodium hypophosphite each hour of operation per gallon of solution. If the bath is operated extra heavy, an addition of half of all the chemicals in the original formula should be added at the end of four hours. With periodic additions of chemicals, the bath will last for several working days before having to be discarded. Filtering the solution will also help in the operation of the process.

Before plating, the following cycle should be employed:

(1) Degrease.
(2) Clean until water break is absent.
(3) Water rinse.
(4) Dip 50% HCl.
(5) Water rinse.
(6) Place in plating bath — If no reaction is shown, bring a piece of iron into contact with the metal surface while immersed in plating solution.

The evolution of hydrogen on the surface of the article when it is immersed into the electroless solution is an indication that normal deposition is occurring. However, there are similar indications if the bath is out of balance and contains too much chromium chloride. A very accurate formulation should be made to obtain good results, and the bath will not tolerate any foreign contamination. It has also been found that the plating

*Patent applied for.

of steel and copper or brass together is advantageous. In some cases the steel will become passive and no plate will result, but, at the same time, a copper or brass part will take the plate beautifully. If one is to plate steel alone, a copper flash should be given first. It has been found that non-ferrous metals take a better electroless deposit of chromium. It has also been found that, in some cases, a steel part must be plated along with a non-ferrous part. This initiates an evolution of hydrogen gas and most of the plating adheres to the non-ferrous part while the steel part will take a light plate.

Type 2 bath, which contains an acetate, is best for steel alone but, in either case, if both ferrous and non-ferrous metals are introduced into the bath together, the plate on both is much better.

Acetate in the form of acetic acid and caustic soda should be added in small proportions of 10 cc. each per gallon per hour of plating along with the hypophosphite.

It is felt that electroless chromium can be the answer to barrel chromium plating of small parts, where operational difficulties are commonly experienced.

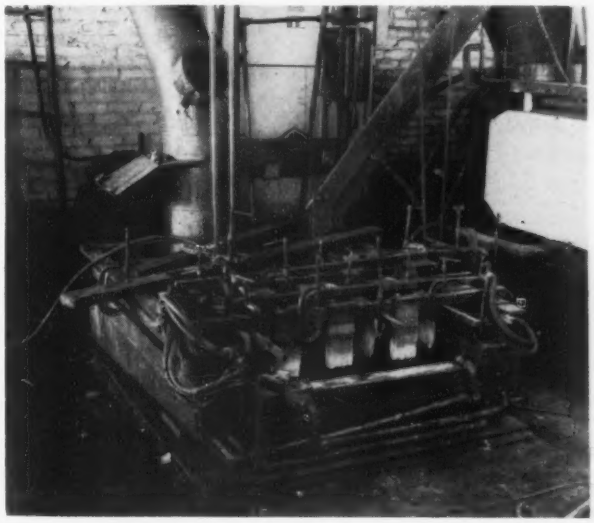
OIL DERRICK

(*Concluded from page* 61)

finish, as well as final polishing after the plating cycle. After-plating buffing facilities are available for work where specifications call for a bright finish when the part is plated to size. Much of the hard chromium plating done in the shop is size plating requiring no after-grinding operations.

After plating, all work is subjected to rigid inspection by the inspection department. This section of the shop is fitted out with a variety of equipment, including a magnetic tester for thickness of deposit. A Swedish device is also available in the gauge room for measuring concentricity, and even deposition of chromium, particularly O.D. plating.

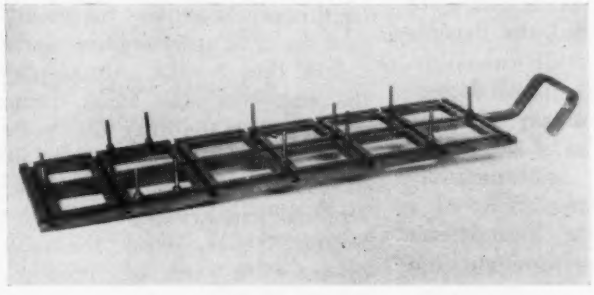
The staff is composed of *Kasmer F. Tarczynski,* formerly an associate of *Dr. R. O. Hull* in Cleveland, O., as general manager; *Stanleigh Megargee* as advertising and promotion director; *John Tarczynski* as sales engineer; *Alfonso Alcantara* as shop superintendent; and *Miss C. A. Ball* as office manager.

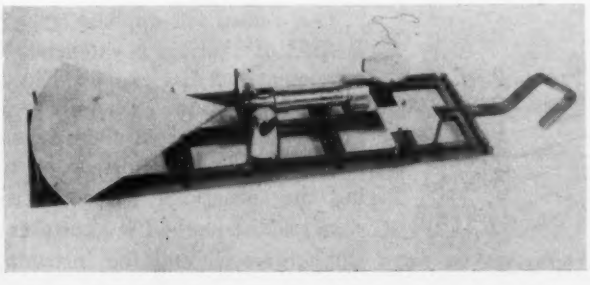


Fourteen foot deep hard chromium tank, 4' square, used for plating I.D. of core and barrel tubes up to 12' in length. An 18' tower was erected on roof immediately above tank to provide headroom for hoisting long items into solution.

Versatile Anodizing Rack

A versatile rack for anodizing aluminum and magnesium alloys has been designed and fabricated by *Sidney Levine* and *George J. Esseff* of the Materials Branch at the Corps of Engineers' Research and Development Laboratories, Fort Belvoir, Virginia.





Shown above is the unloaded rack and below the same rack adjusted to hold various shaped parts.

Made of aluminum 62S and pure titanium, it is designed to accommodate jobs requiring racks of a wide variety of sizes and shapes. The developers consider titanium the most promising material for fabrication because it is extremely resistant to chemical attack by the cleaning treatment, and forms a light non-insulating oxide coating when subjected to the anodic treatment. Thus, the titanium-made rack need not be cleaned between runs, and offers long life.

The rack features mobile contact points. Separate and complete units, they can be moved along a track to the desired dimension and set by means of a locknut to provide effective and excellent electrical contact.

Great savings have been realized in money, time, materials and storage space by the use of three 6½" x 25" racks at the Laboratories. The three facilitated anodizing jobs which would have ordinarily required as many as 60 racks of different dimensions.

In common practice it is necessary to rely upon racks that fit the dimensions of a particular job to anodize aluminum and magnesium alloys. This results in an expensive stockpiling of racks with future limited use.

Levine and Esseff have applied for a patent on their unique rack.

Science for Electroplaters

5. Transmutation

By L. Serota

THE development of the modern nuclear structure concept has its beginning with the study of naturally radioactive elements. The names of Ernest Rutherford and his collaborators are generally linked with the pioneering efforts in the success of this theory. Reference is commonly made to the "Rutherford" nuclear atom.

The first artificial reaction involving the nucleus was achieved in 1919 by Rutherford and James Chadwick. By bombarding the nitrogen atom with alpha particles (helium nucleus), emitted from radium C, they converted the nitrogen into an oxygen isotope and a proton (hydrogen nucleus). This reaction is known as transmutation. The equation follows:

$^{14}_{2}N + {}^{4}_{2}He \rightarrow {}^{17}_{8}O + {}^{1}_{1}H +$ energy.

The alchemists' dream of changing one element into another had indeed come true.

The discovery of this type of reaction led to the development of artificial radioactivity, first achieved by Irene Joliot-Curie and her husband Frederic in 1934. This discovery was followed by fission and the utilization of energy liberated by this reaction. The last development, announced in 1939, was demonstrated with awe-inspiring effect when the bomb was exploded over Hiroshima in 1945.

Atomic Spectra

Characteristics of the atom such as mass are associated with the nucleus; chemical properties of the atom are related to the electrons of the outermost level surrounding the nucleus. The accepted arrangement of electrons surrounding the nucleus can be attributed, to a great extent, to the information derived from the study of atomic spectra.

A spectrum is produced when a narrow beam of visible light from a source such as heated solids or incandescent vapors is passed through a glass prism. When a solid such as iron is heated to a white heat (about 2700°C.) the radiation emitted is bent or refracted by the glass prism into a series of colored rays ranging from red at one end of the band, through orange, yellow, green, blue, to violet at the other end of the band (fig. 11). The same effect can be observed when sunlight is refracted by raindrops into a rainbow. The longer red rays (waves) are bent the least and the shorter violet rays bent the most. This scale of primary colors is called the "visible spectrum."

The light emitted by incandescent vapors, when refracted by a glass prism, produces a series of sharp lines spaced according to mathematically precise laws, and characteristic of a particular element. The incandescent vapors, for example, of sodium or a compound of sodium (common salt) will give a characteristic bright yellow spectral line. This is known as a line spectrum (atomic spectra).

Spectrum analysis is made with an instrument known as a spectroscope. Because the lines representing the spectrum of an element are characteristic for a specific element, investigators have found this instrument to be a most effective tool in the detection of elements. It is sensitive to the detection of minute quantities. About twelve metals have been discovered through the use of the spectroscope. This method of analysis, introduced by Bunsen and Kirchoff in 1849, enabled them to discover two new elements which resembled sodium and potassium, namely cesium and rubidium. The name rubidium (ruby) was chosen because it denotes the prominent bright line, which is a dark red color. In like manner, the selection of the name cesium (bluish-gray) stands for the blue color of its spectral line. The sensitivity of the detection of new elements is such that minute quantities, as in the case of rubidium and cesium, can be detected.

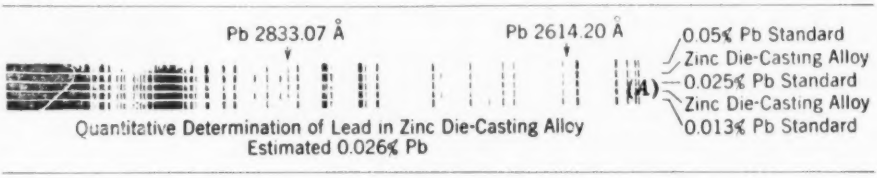


Figure 12.

An example of the extraordinary powers of discovery of new elements by this procedure was the observation of a series of spectral lines, one a new yellow line, in the chromosphere of the sun, that was made during an eclipse. Since the lines were not previously known, the investigator Lockyer, in 1869, concluded that these lines represent a new element which he called helium (helios, Greek for sun). Its existence on earth was confirmed in 1894 by William Ramsay, who discovered it in cleveite, a form of the mineral pitchblende.

The industrial application of this method of analysis is extensive. A development that has expanded its application is the device whereby a photographic recording of the spectrum is made. This is accomplished by replacing the observing telescope with a camera. The method is known as spectrophotometry, and the instrument is

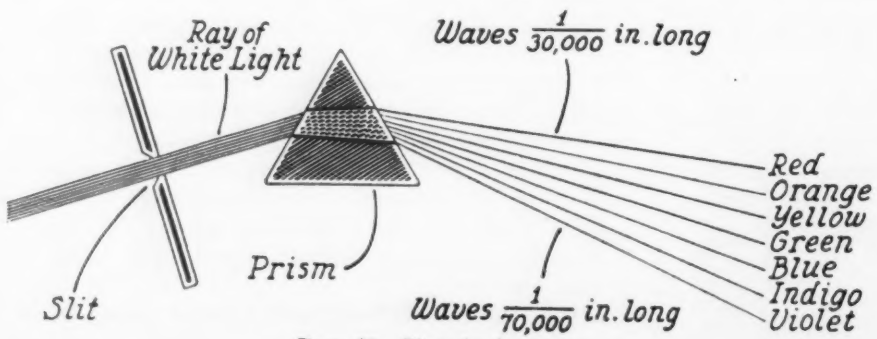
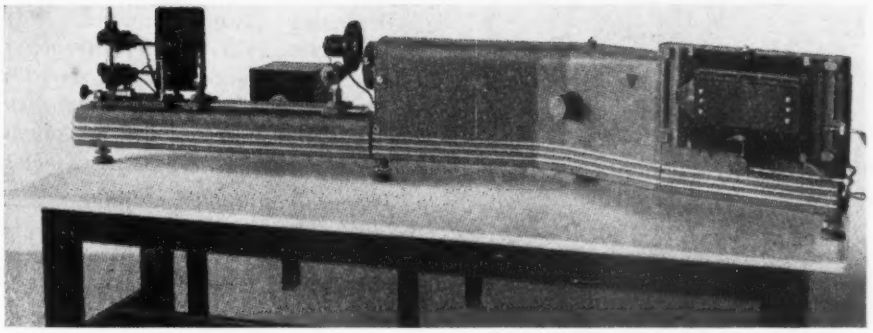


Figure 11. Dispersion by a prism.



(Courtesy Bausch & Lomb Optical Co.)

Figure 13. Medium quartz spectograph and illuminating unit.

called a spectrograph or spectrophotometer (fig. 13). An example of its use is the photograph of a spectrographic analysis, whereby a quantitative determination of the amount of lead in a sample of zinc die-casting alloy is made (fig. 12). Two spectra of the alloy are photographed for comparison, between standards containing known amounts of lead. This is a rapid and accurate method of analysis which has immense value in industrial control.

Beyond the visible violet in the spectrum is the range of radiant energy known as ultraviolet, and beyond the visible red is the infrared range. Both are invisible to the eye but may be photographed on an appropriate emulsion. The complete spectrum for radiation extends from the extremely short wave lengths of x-rays and gamma rays, an Angstrom unit (1/100,000,000 cm. which are measured in hundredths of an Angstrom unit (1/100,000,000 cm.), to the very long radio wave lengths measured in distances of thousands of meters. The narrow portion of the visible spectrum in respect to the full scale of the electromagnetic spectrum is evident in Fig. 14.

Bohr Orbits

It is known from classical physics that a mass moving in a circle is accelerated toward the center. In addition, if this mass has a charge, it will radiate energy. Neils Bohr postulated, however, that the electron is not permitted to radiate energy while it is revolving in one of the stable orbits. Otherwise the orbit would continue to decrease in size until the electron fell into the nucleus. This explanation is a radical departure from the previously accepted view and provides a satisfactory explanation for the atom maintaining its structure.

The spectrum of the hydrogen atom was interpreted by Bohr in terms of the orbits occupied by the extra nuclear electron. He assumed in his theory that the electron of the hydrogen atom can revolve about the nucleus in a limited number of permissible orbits called stationary states. The electron is not permitted to radiate energy while it is revolving in one of these stable orbits.

This energy may be applied from an outside source either by adsorption of radiant energy or by collision with a fast moving particle such as an electron, proton, or neutron. The electron will return at once to its normal state (ground level) with the liberation of energy. The energy previously acquired will then be liberated as radiation and be visible as a spectral line. In accordance with the quantum theory, a spectral line represents the difference in energy between the two levels. The wave length of this spectral line is proportional to the energy emitted.

Electronic Distribution

The proposed distribution of the electrons around the nucleus of each element, following hydrogen, is based upon information derived from:

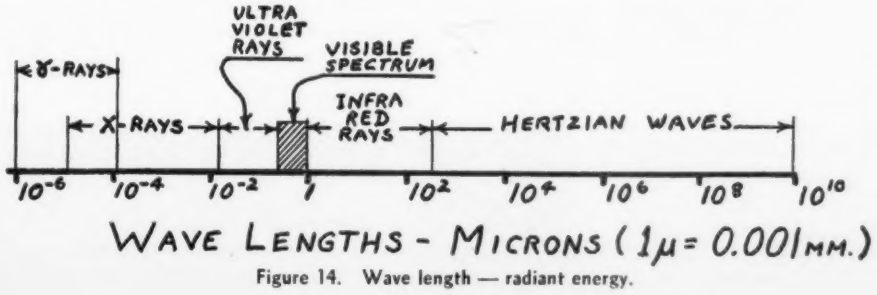


Figure 14. Wave length — radiant energy.

1. A study of the spectral lines of the elements.

2. Consideration of the chemical characteristics as indicated by the arrangement of the elements in the periodic table.

A striking agreement, in electronic configuration, is obtained by both methods.

The similarity of the simple series of spectral lines for the alkali metals lithium, sodium, potassium, rubidium, and cesium, led to the proposal by Bohr and Stoner that the orbital plan of the hydrogen atom could be extended to all the elements in the periodic table. Each member in this group, by such plan, would represent the beginning of a new electron shell (quantum number). Each of the alkali metals would have just one electron in the outermost orbit. The maximum number of electrons possible for filling a shell is determined by a "selective rule" (Pauli's Exclusion Principle) that corresponds to the mathematical expression $2n^2$, where n represents the quantum number. For the first shell, $n = 1$, the maximum number of electrons it could hold would be two ($2 \times x^2 = 2$), the second shell would hold eight ($2 \times 2^2 = 8$), the third eighteen and so on. The outermost shell, however, may never contain more than eight electrons. The arrangement for the six electron shells (quantum numbers) corresponding to the first six horizontal rows in the periodic table is as follows:

Quantum number, n =	1	2	3	4	5	6
Number of electrons	2	8	18	32	50	72

The letters K, L, M, N, O, P are also used to represent the quantum numbers 1 to 6. Each letter represents a series of lines corresponding to the x-ray spectrum of an element. The spectra obtained were associated by Moseley with the atomic numbers of elements.

The number of orbital electrons for an atom, as stated in a previous section (III), is equal to the number of protons in the nucleus. The atom thereby maintains a neutral status.

The second interpretation of the electron shell arrangement, based upon the chemical inactivity of the inert gas elements helium, neon, argon, krypton, xenon, and radon, was suggested in 1916 by both Lewis and Kossel. They expressed the same view independently

Table 1.

	Atomic number	*Number of electrons in energy levels Quantum number* $n=1$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
Helium	2	2					
Neon	10	2	8				
Argon	18	2	8	8			
Krypton	36	2	8	18	8		
Xenon	54	2	8	18	18	8	
Radon	86	2	8	18	32	18	8

Table 2.

	Atomic number	*Number of electrons in energy levels Quantum number* $n=1$	$n=2$	$n=3$	$n=4$	$n=5$	$n=6$
Lithium	3	2	1				
Sodium	11	2	8	1			
Potassium	19	2	8	8	1		
Rubidium	37	2	8	18	8	1	
Cesium	55	2	8	18	18	8	1

that the chemical inaction of these inert elements could be attributed to the existence of completed electron shells. The distribution of the electrons would entail the building up of successive shells, with each inert gas representing an element with the maximum number of electrons for that energy level. With the exception of helium, which contains two electrons, the outermost shell of each of the inert elements would contain eight electrons. The chemical activity of elements could thus be ascribed to the tendency of the atom to attain this completed (stable) structure.

Langmuir associated the increase in atomic number with the successive filling of the electron shells. This represented an electronic configuration that corresponded to the arrangement of elements with similar properties in the periodic table. Consider the alkali metals. Lithium, the third element, atomic number three, would have one electron in the second shell. Sodium, the eleventh element, with chemical properties similar to those of lithium, would have the first two shells completed and the additional electron would be found in the third shell. The order of the electrons for the three quantum levels for sodium would be 2-8-1. Potassium, atomic number 19, follows the same order as sodium with one electron in the fourth energy level, 2-8-8-1. The two shells $n = 2$ and $n = 3$ comprising the elements lithium to neon ($n = 2$) and sodium to argon ($n = 3$) are known as the short series. In both these series, the outer shell is built up in the same manner. The fourth shell $n = 4$, consisting of the elements from potassium to krypton (18 elements), is the first of the long periods.

Beginning with scandium (Sc) atomic number 21, the fourth energy level does not continue to fill up with electrons. Instead, the inner third shell begins to increase to its maximum number of eighteen electrons.

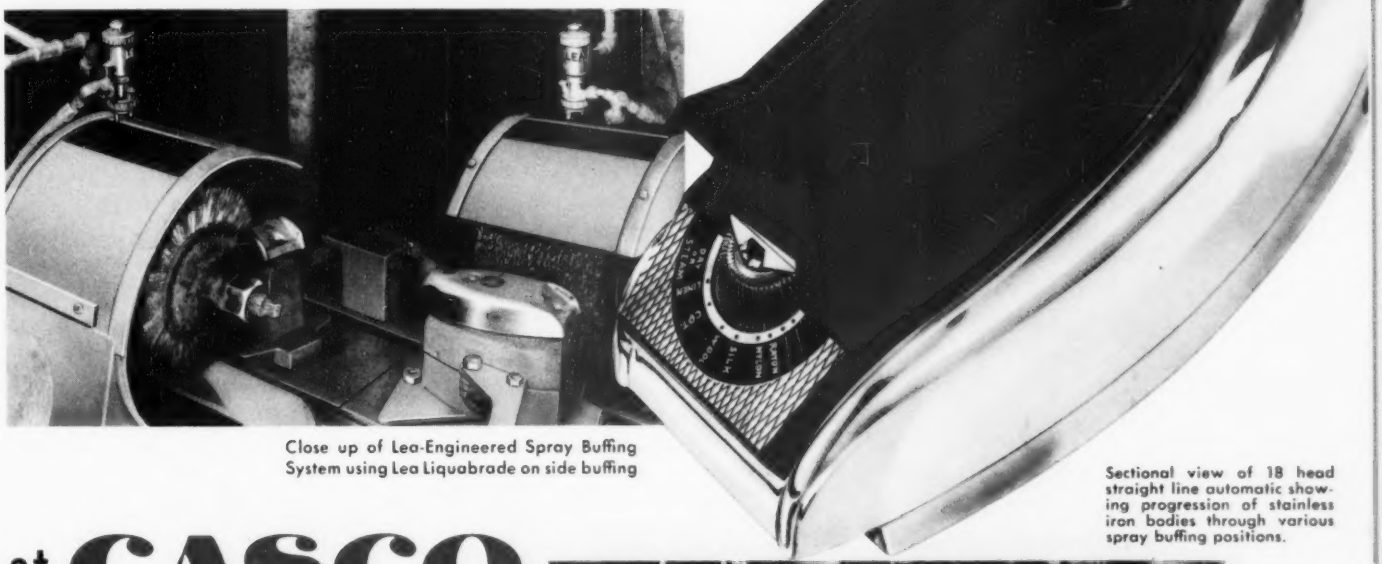
This order, proposed by Bury, agrees with the arrangement of the elements in the periodic system. The elements extending from scandium to nickel, containing incomplete inner shells, represent one of three such groups of elements classified as transition series. The elements yttrium (Yt), atomic number 39, to palladium (Pd), atomic number 47, comprise the second transition series. The third series of transition elements begins with lanthanum (La), atomic number 57, and extends through platinum (Pt), atomic number 78.

Many of the physical and chemical characteristics of the elements in these transition series are associated with the irregular electronic configurations. Such elements are metals and are characterized by their high melting points, ability to form alloys, magnetic properties, and the formation of colored ions for the solid salt or when in solution. Nickel salts, for example, are green as solids or when in solution. The use of the magnetic type gauges by the plater in determining the thickness of a nickel deposit on steel depends upon the magnetic properties of the basis metal and the deposited metal.

The following tables illustrate the electronic distribution representing the accepted chemical and optical characteristics for groups (families) of elements. For the inert gases the outer shell for each element, with the exception of helium, contains eight electrons. In the second table, consisting of the alkali metals, the outer shell for each element contains one electron.

LEA LIQUABRADE

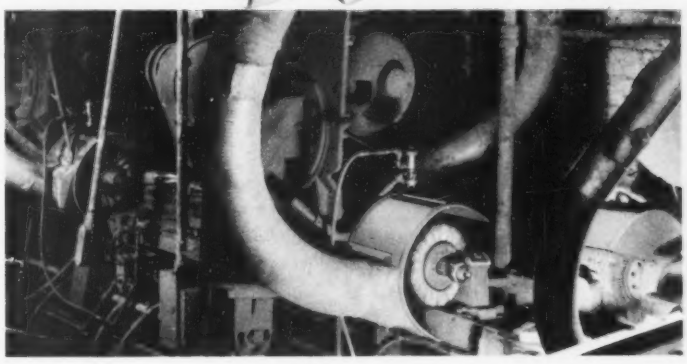
for HIGH SPEED – LOW COST AUTOMATIC finishing of stainless steel



Close up of Lea-Engineered Spray Buffing System using Lea Liquabrade on side buffing

Sectional view of 18 head straight line automatic showing progression of stainless iron bodies through various spray buffing positions.

at CASCO



These gay new Casco Steam and Dry Irons are gleaming, durable, stainless steel . . . inside and out. Uses plain tap water even in hard water areas. And, to get this gleaming finish on the stainless steel case, CASCO uses LEA LIQUABRADE with the Lea-Engineered Spray Buffing System.

Yes, sir . . . and CASCO uses LEA LIQUABRADE on a big straight line automatic buffing machine that really does a job. From rough draw to high lustre in a continuous high speed, low cost, automatic operation.

For real finishing line flexibility you can't beat the Lea Spray Buffing Package Plan — Lea Liquabrade and Lea-Engineered Spray Buffing Equipment. May we help you put your finishing line on a PAY-LESS-AS-YOU-GO basis?

The LEA GROUP
serving the Finishing Field
The Lea Mfg. Co., Waterbury, Conn.
Lea-Michigan, Inc., Detroit
Lea-Ronal, Inc., Long Island City, N. Y.
Lea Mfg. Co., of Canada, Toronto
Plating Polishing Buffing Burring

Burring, Buffing, Polishing, Lapping, Plating and Spray Finishing . . . Manufacturers and Specialists in the Development of Production Methods, Equipment and Compositions.

Manufacturers of Lea Compound and Learok . . . Industry's quality buffing and polishing compounds for over 30 years.

THE LEA MANUFACTURING CO.
16 CHERRY AVE., WATERBURY 20, CONN.

Are you interested in Plating Specialties? SEE THE OTHER SIDE OF THIS INSERT

Lea-Ronal

points the way toward MORE ECONOMICAL and SUPERIOR high speed 'bright' finishes for the silver plater...

STILL or BARREL PLATING

If you are silver plating articles such as those illustrated, for either decorative or industrial use, you should investigate the Lea-Ronal Bright Silver Process. Full scale production in numerous shops is proving:

LOWER COSTS because deposits are 'bright' as they come from the bath, scratch brushing can be completely eliminated; also coloring in many cases.

LOWER COSTS because plating time is reduced as a result of the high current density (0-60 ASF Hull Cell) used in normal operations. You get more work from existing equipment. Extra floor space and equipment are not needed for increased production schedules.

LOWER COSTS because operations are at room temperatures.

LOWER COSTS because AgCN additions are reduced to a minimum — in fact, may be completely eliminated with proper operations.

SUPERIOR PLATING because deposits are harder than deposits from conventional cyanide baths yet retain desirable ductility. Thus, they have greater wear resistance without sacrificing ductility.

SUPERIOR PLATING because the process can operate with extra high current densities (see above) for the production of extra heavy deposits, as for bearings.

SUPERIOR PLATING because solutions are crystal clear, work is completely visible at all times. Better visual control.

SUPERIOR PLATING because silver deposits from Lea-Ronal Bright Silver have better tarnish resistance than those from conventional plating baths.

And back of all this is the service of the experienced Lea-Ronal Technical Staff ready at all times to help you improve not only your silver plating as outlined above but copper, nickel and gold industrial and decorative plating as well.

The LEA GROUP
serving the Finishing Field
Lea-Ronal, Inc., Long Island City, N. Y.
Lea-Michigan, Inc., Detroit
The Lea Mfg. Co., Waterbury, Conn.
Lea Mfg. Co., of Canada, Toronto
Plating Polishing Buffing Burring

Lea-Rona! Inc.

Main Office and Laboratory:
42-48 27th Street, Long Island City 1, N. Y.

Sales and Manufacturing Plant:
237 East Aurora Street, Waterbury 20, Conn.

SHOP PROBLEMS

ABRASIVE METHODS SURFACE TREATMENTS CONTROL
ELECTROPLATING CLEANING PICKLING TESTING

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Plating Over Electroless Nickel

Question: We are experiencing difficulty in obtaining excellent adhesion of copper deposits to electroless nickel, especially when a palladium dip is necessary to initiate nickel formation on a non-catalytic surface such as copper, brass, plastic, etc.

It appears that it may be the palladium dip which is causing the trouble since we get fair to good adhesion when we copper plate without using the palladium dip but use the steel contact method to start electroless nickel formation. Unfortunately, in certain cases, we have to use the palladium dip such as when we plate nonconductors. We can employ either cyanide or acid copper for the deposits over the electroless nickel, and have used both the West and Brenner methods with the same results.

E. I., Inc.

If any reader has had any experience with this problem and wishes to disclose his method of solving it, we will forward his reply to our inquirer and will keep his identity undisclosed, if desired.

Ed.

Flowing Tin Plate

Question: My problem concerns the plating of tin from an alkaline bath. Objects are either of steel or brass. The bath is a normal potassium stannate bath of a composition as follows: Sn: 5.0-5.3 oz./gal.; Free alkali: 1.5-2.0 oz./gal.; Total alkali: 7.0-10.5 oz./gal. The bath is operated at 170°F. and concerted efforts are made to control anode behavior. The anodes are assumed to be of pure Sn.

The plated parts emerge from the bath in a light matty color showing no signs of defectiveness. All plating is done in barrels. Subsequent to plating, the work is reflowed in an oil bath maintained at 500°F. using a vegetable oil. After fusing. the work surfaces show dark, irregularly shaped areas which darken further upon aging. Perchloroethylene is used for removing the oil film.

F. J. W.

Answer: Since the tin deposit, as removed from the plating barrel, shows no signs of defectiveness, we would assume that your trouble is in the flowing operation or in the rinsing after tin plating. Insufficient rinsing will result in dragging alkaline salts into the oil bath, which may react at the high temperature either with the tin surface or with the oil, thus changing its characteristics. We are assuming that a suitable flowing oil is being used.

Our suggestion would be to have the oil analyzed to see whether salts are being dragged in and, if so, the rinsing should be improved prior to tin flowing.

Tarnishing of Gold Plate

Question: We manufacture various types of small embossed and enameled emblems which are usually in a gold plated finish. Sometimes they have a rose gold smut in them and then flashed later, but we usually always finish them in 24 kt. gold solution. Many of our customers like to have these emblems unlacquered. We have found that the emblems that we have supplied tarnish after a little length of time, even in a package that we shipped to the customer.

If there is anything you can do to help us alleviate our troubles we would be happy to hear from you.

A. E. G.

Answer: Tarnish of unlacquered gold plated emblems is generally due to penetration of the atmosphere through the thin plate, attacking the brass or bronze basis metal. The most effective method of preventing this condition is to nickel plate before gold flashing. Even a light nickel deposit will help quite a bit.

Brittle Hard Nickel

Question: This is the first time that I have availed myself of your "Shop Problems," but we really have one. We are in the plating business in a big way, but have been unable to find the reason for, or solution of, internal stress and checks in our hard nickel. The formulation is $NiSO_4$—24 oz./gal.; NH_4Cl—3-3; boric acid—4.0; Temp. —138°F.; pH from 4.0 to 5.6.

We have tried various degrees of pH and get best results at the low range, around 4.0. There are no signs of checks or stress with a build-up to .005"; over that small cracks appear as build-up increases until the breaking point is reached. We have constant agitation and filtration and use thiourea as an additive.

We have read all available literature on the subject but are unable to find an answer to our problem.

G. E. A.

Answer: The thiourea may be a cause of the excessive stress, since this is not a common addition to a hard nickel bath, the formula for which appears satisfactory. Saccharine in small amounts is often added to reduce the stresses in nickel deposits.

Tarnish of Silver and Gold Deposits

Question: Our problem is an old one, familiar to companies handling or working in any way with silver. The problem is tarnish and its control, or, if possible, elimination. We also have this same problem of tar-

nish on gold-plated parts but to a lesser extent. Could you help us in some manner, possibly by furnishing us with procedures or publications on the subject? Your earliest possible reply will be greatly appreciated. We have grappled with this problem for some months and are no further along now than at any time in the past.

R. E. G.

Answer: The problem of tarnish is present in all plants which deal with silver. Tarnishing may be minimized by careful rinsing and thoroughly drying parts which have been plated, then storing in a dry atmosphere. There have been a large number of treatments suggested in the trade and patent literature for eliminating tarnish on silver.

Tarnishing of gold plated parts is generally due to tarnish of the base metal through the thin gold deposit, rather than of the deposit itself, so that the same precautions suggested above will hold true.

Pickling Managanese-Copper Alloy

Question: Our company is considering the fabrication of radar waveguide components, made from a Manganese-Copper alloy, a sample of which we are forwarding to you. During the silver brazing operation, we find that a considerable amount of oxidation is formed, which is very difficult to remove in the many solutions tried.

I would like to draw on your wealth of information in metal finishing to solve the problem of the pre-treatment of this alloy before plating. You should bear in mind that unless some better form of brazing is found, I will reecive these components in a badly oxidized condition; also, that most of the components will be rectangular tubes approximately .400 x .900 I.D.. and that the inside plating must be as good as the outside.

If you know of a suitable electropolishing or other anodic treatment that would prepare this surface for plating, we would be very interested to know of it.

F. R. D.

Answer: This alloy is quite readily attacked by acids which will make the matter of preparation for plating quite difficult. The flux should be removed by soaking in hot water, following which the parts may be given a short dip in a dichromate pickle containing ½ pint of sulfuric acid and ¼ lb. sodium or potassium dichromate per gallon. We know of no electropolishing solution which has been employed.

For best results on this metal, a non-oxidizing atmosphere should be employed for the silver brazing operation since removal of the scale will probably result in a smut which will be difficult to remove from the inside of the tubes.

PROFESSIONAL DIRECTORY

PROPHON ENGINEERING CO.
Polishing & Buffing Consultants
Originators of the
PROPHON BUFFING METHOD
Office: 545 Fifth Ave. New York, N. Y. MUrray Hill 7-6868
Laboratory: 561 Broad St. Elizabeth, N. J. ELizabeth 2-4409

HENRY LEVINE & SON, Inc.
Metal Finishing Consultants
Analysis of all electroplating solutions
Engineering of finishing installations
Air Force Certification Tests
Salt Spray Thickness and Adhesion Tests
153 East 26th St., New York, N. Y.
MUrray Hill 5-9427

METAL FINISHING CONSULTANT
PLANT AND PRODUCT
CONTROL — DESIGN — LAYOUT
ENGINEERING APPLICATIONS
J. B. MOHLER
302 EUCLID AVE. NEW CASTLE, PA.
OLiver 4-7617

METAL FINISHING CONSULTING SERVICE
TESTING - RESEARCH - DEVELOPMENT
Chemical and Metallurgical Control.
Spectographic, X-ray, Organic.
AIR FORCE CERTIFICATION TESTS.
The FRANK L. CROBAUGH CO.
1426 W. 3rd St. Cleveland 13, Ohio

METAL FINISHING CONSULTANT
With a well-known record of achievement. Let me help you.
Since 1928 **C. RAYMOND SYER**
P. O. Box 3273 Beverly Hills, Calif.

THE ANACHEM LABORATORIES
TESTING ANALYSES ENGINEERING
For Metal Finishers
Plating solution analyses and control. Testing of deposit-thickness, composition porosity, tensile strength. Salt Spray tests.
AIR FORCE CERTIFICATION TESTS
1724 West 58th St., Los Angeles 62, Calif.
AXminster 4-1262

INDUSTRIAL ELECTROPLATING LABORATORIES
E. 271 ASHLEY PL. PARAMUS, N. J.
COlfax 2-4520
Anodizing and plating consultants • Army-Navy-Air Force certification tests • Chemical analysis of all plating solutions • Research, development and plant design • Industrial waste water treatments • Quality control and troubleshooting.

SURVEY, DESIGN, INSTALLATION ASSISTANCE
D. R. ROBSON ASSOCIATES, INC.
Consultants to the Electroplating & Metal Finishing Trades
P. O. BOX 1 CHELTENHAM, PA.
MELROSE 5-6287

GEORGE W. SLOMIN & ASSOCIATES
Metal Finishing Consultants
SUITE #5, 725 N. WESTERN AVE.
LOS ANGELES, CALIF.
Phone: Hollywood 4-3590
Research and Development in Advanced Electrochemistry, Metallurgy and Electronic Process Control.

SCIENTIFIC CONTROL LABORATORIES
Finishing Consultants—Registered Engineers
Salt Spray—Thickness Testing—Analyses
PLANNING—RESEARCH—DEVELOPMENT
HAymarket 1-2260
600 BLUE ISLAND AVE., CHICAGO 7, ILL.

ENGINEERED INSTALLATIONS
COMPLETE PLANTS INSTALLED
DESIGN • LAYOUT • CONSTRUCTION
CHESTRE INDUSTRIAL CO., INC.
10-02 38th Ave., Long Island City, N. Y.
STillwell 4-0549

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
Metal Finishing — Electrodeposition — Solution analyses. AIR FORCE CERTIFICATION TESTS — Salt spray, thickness of deposits, adhesion.
44 East Kinney St. Newark 2, N. J.
MArket 3-0055

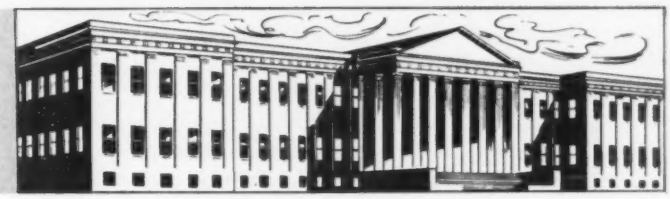
ERNEST J. HINTERLEITNER
3325 CLAIREMONT DRIVE
SAN DIEGO 17, CALIFORNIA
Browning 6-1670
Research - Engineering - Consulting
1926/1955 - U.S.A. and Foreign

PLATERS TECHNICAL SERVICE, Inc
ELECTROPLATING AND CHEMICAL ENGINEERS
- Air Force certification tests
- Salt Spray, thickness and adhesion tests
- Spectographic analysis
- Solution, Metal and Salt analysis
- Plant Design and Engineering
- Plant layout and construction
- Industrial waste and water supply treatment

NEW YORK LABORATORY 39 East 4 St., New York 3 ALgonquin 4-7940
CHICAGO LABORATORY 509 S. Wabash Ave., Chicago 5 HArrison 7-7848

Patents

RECENTLY GRANTED PATENTS IN THE METAL FINISHING FIELD



Method of Making Chrome Plated Piston Rings

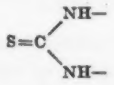
U. S. Patent 2,696,038. *Dec.* 7, 1954. *M. C. Hunt, assignor to Perfect Circle Corp.*

The method of making a chrome plated radially slotted piston ring, which comprises cutting separated slots extending inwardly from the outer periphery of the ring but terminating short of the inner periphery to leave an imperforate inner surface, chrome plating the outer periphery of the ring, and thereafter cutting an annular groove in the inner periphery of the ring of a width at least equal to the axial width of the slots and radially aligned with the slots and of a radial depth sufficient to open into the inner ends of the slots.

Bright Acid Copper

U. S. Patent 2,696,467. *Dec.* 7, 1954. *D. M. Overcash and R. B. Parks, assignors to General Motors Corp.*

An electrolyte for electrodeposition of copper consisting essentially of an aqueous copper sulfate solution containing free sulfuric acid and to which has added a compound having the nucleus



in an amount within the range of .0003 to .67 ounce per gallon of solution and an ingredient selected from the class consisting of lignin sulfonic acid and salts of lignin sulfonic acid in an amount within the range of .001 to .5 ounce per gallon of solution.

Ceramic Coated Chromium Steel

U. S. Patent 2,697,670. *Dec.* 21, 1954. *A. Gaudenzi and H. Giger, assignors to Aktiengellschaft Brown, Boveri & Cie.*

An article comprising a metallic object formed of an alloy consisting essentially of iron and from about 14% to about 30% of chromium, and a ceramic coating on said object said coating comprising a first layer in contact with said object of ceramic enamel substantially free of magnesium oxide and containing from about 2% to about 12% of chromium oxide and at least one layer of ceramic enamel superposed upon said first layer, said superposed layer containing at least about 10% of magnesium oxide.

Metal Spraying

U. S. Patent 2,697,671. *Dec.* 21, 1954. *J. B. Brennan.*

In a continuous method of producing spray deposited metal sheet in strip form the steps of, arranging a base strip to form a helical winding comprising serially connected edgewise contiguous turn portions, creating a molten metal particle spray field of different densities laterally thereof and having a maximum density substantially centrally thereof and a minimum density at its lateral edges, substantially continuously advancing the base strip through the successive turn portions of said winding for substantially continuously moving the base strip both longitudinally and edgewise through said spray field, successively forming sprayed metal deposits of varying thickness on the longitudinally and edgewise moving base strip with portions of said deposits on different turn portions of said winding and with portions of said deposits in superimposed relation such that said deposits form an aggregate spray deposited metal strip of substantially uniform thickness transversely of the base strip, and leading the base strip with the spray deposited metal strip thereon substantially continuously and in a substantially straight line away from said winding.

Sealing Anodized Aluminum

U. S. Patent 2,698,262. *Dec.* 28, 1954. *F. Balmas.*

In the method of sealing an anodized oxide coating formed on aluminum, the step of coating the oxide coating with a dilute solution consisting essentially of chlorinated diphenyl as the substance which remains upon elimination of the diluent, and then drying the treated coating at elevated temperature up to about 120°C.

Buffing Wheel

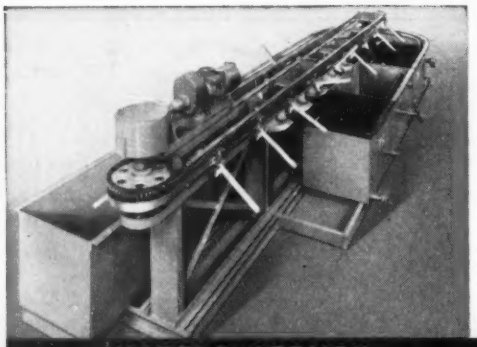
U. S. Patent 2,698,504. *Jan.* 4, 1955. *E. L. Lotz, assignor to Harvel Research Corp.*

A novel buffer comprising a plurality of approximately disc-shaped layers laid flatwise one on the other and secured together with each layer comprising a woven glass fabric having a count in the range of 40 x 30 to 90 x 60, said fabric comprising yarn containing from 150-408 individual glass filaments, and alkyl phenyl polysiloxane resinous binder for said filaments, the quantity of said binder in said fabric being in the proportion of .5-2 ounces of binder to 1 square yard of said fabric.

Testing Pickling Baths

U. S. Patent 2,697,673. *Dec.* 21, 1954. *J. K. Rice, assignor to Cyrus Wm. Rice & Co.*

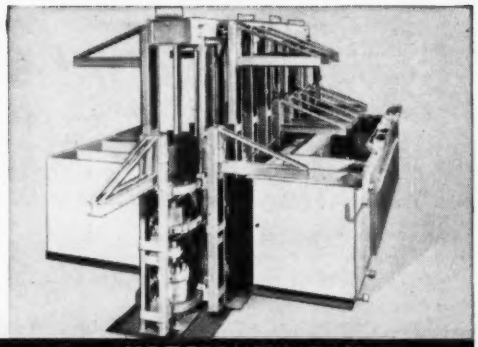
The method of removing an inorganic coating from a metallic surface and simultaneously testing the effectiveness of a pickling solution, said method comprising the steps of immersing a member having at least a portion of its surface bearing a substantial coating of the type to be removed by said pickling solution and defining first electrode means; immersing substantially uncoated second electrode means into said pickling solution; said pickling solution acting as an electrolyte and defining with said electrode means at least one cell; linking said electrode means solely to themselves by current conductive means and a poetntial measuring device to define at least one closed circuit cell; and measuring with respect to time the drop in potential as the



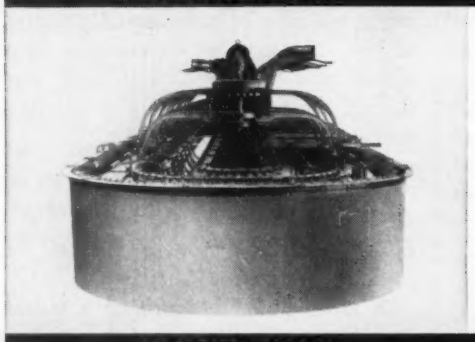
"LITTLE STEVE"
Rack Type Machine

Low initial and low operating costs are features of this newly introduced small automatic which has a big capacity for its size.

Unit's load capacity, mechanical flexibility and lift design meet tomorrow's increased safety and production requirements.



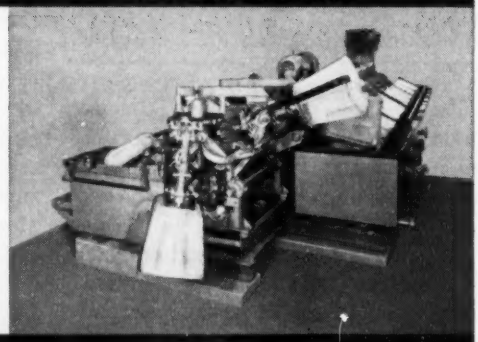
"STEVADOER"
Rack Type Machine



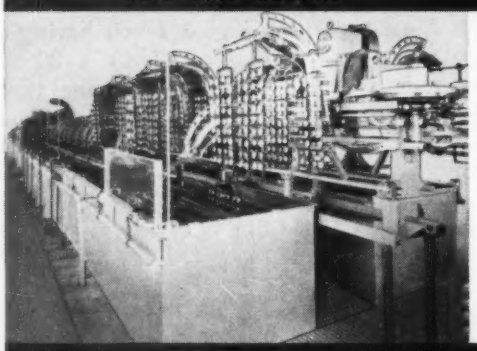
MODEL "A"
Rack Type Machine

A compact automatic processing machine, embodying the famous Stevens auxiliary cam shaft and lifters for rapid vertical transfer.

A proven automatic barrel machine for plating and processing small parts. Only unit with fully automatic load and unload features.



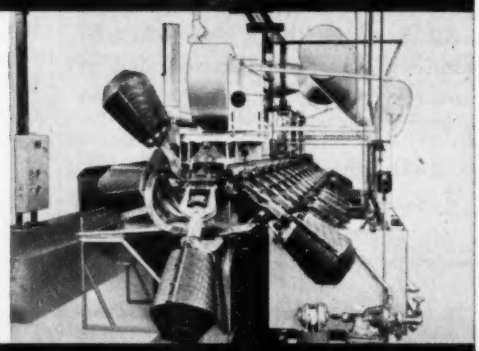
MODEL "C"
Barrel Type Machine



MODEL "B"
Rack Type Machine

Features rapid, continuous movement processing employing hump type cams. Design permits utmost mechanical and cycle flexibility.

Large capacity automatic barrel unit for volume production. Embodies major features of the famous Stevens Model "C" machine.



"SUPER E"
Barrel Type Machine

AN AUTOMATIC MACHINE FOR EVERY METAL FINISHING NEED

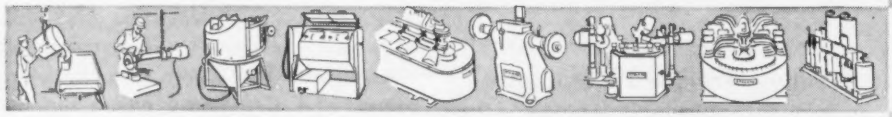
The Stevens family is now complete. Six Stevens automatic plating and processing machines fill every need for metal finishing.

• Latest addition to the complete line of Stevens automatic metal finishing machines is "Little Steve." Announcement of the new "Little Steve" follows by a few months the recent introduction of Stevens heavy-duty "Steveadoer" Processing machine.

Now you can go automatic in any and all of your plating operations. Stevens can furnish a job-engineered, cost-cutting, fully automatic machine that will answer every production need whether it be for electroplating, cleaning, anodizing, bright dipping. You will get better control, better finishes and eliminate rejects with Stevens Automatics.

Why not see how one of Stevens great family of automatics can be engineered for your metal finishing operations? Call in a Stevens Sales Engineer today or write direct to –

BRANCHES: BUFFALO • CLEVELAND • INDIANAPOLIS • NEW HAVEN



FOUNDRY FACINGS | GRINDING OPERATIONS | BLAST FINISHING | BARREL TUMBLING | METAL CLEANING | POLISHING & BUFFING | AUTOMATIC FINISHING | AUTOMATIC PLATING | METAL RECLAMATION

Metal Finishing equipment and supplies from castings or stampings to finished product.

FREDERIC B. STEVENS
INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

THE FINISHING TOUCH

WATCH YOUR WASTE LINE

by A. B. Hoefer
Vice-President, Frederic B. Stevens, Inc.

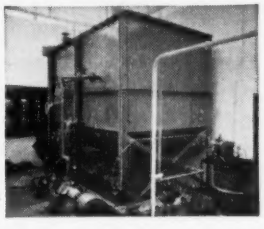
The "waste line" we are talking about runs from your plating, anodizing and similar processing tanks. It carries a surprising portion of the chemicals for which you have paid good money literally down the drain.

A Stevens survey for one company showed that 85 percent of the chromium used in their plating department disappeared in this manner . . . It cost six dollars' worth of chromium to put one dollar's worth on the finished product.

Well, what's the answer? We at Stevens, with our experience in the metal finishing field, decided that disposal of unwanted wastes and conservation of water and chemicals was a problem we could solve for you.

Amazing results have been accomplished by multiple reclaim tanks that produce 50 to 80 percent savings. As much as 95 percent saving in rinse water has resulted from multiple rinse tanks.

Consequently, Stevens pioneered again and have completed engineering and installation of



This waste disposal unit treats chromium and cyanide plating solutions.

numerous successful cost-saving waste treatment systems for industry.

The Stevens Ion-Exchange system, too, has solved many plating and anodizing waste control problems. It also saves for reuse nature's all-important gift—water.

The latest Stevens development is a "package" plating room waste treatment unit for destroying cyanide. It can also be adapted to treatment of chromium, alkaline, acid and nickel as well as acid copper rinse waters.

If you have "waste line" problems, write us or contact your Stevens Sales Engineer today.

FREDERIC B. STEVENS
INCORPORATED
YOUR METAL FINISHING SUPERMARKET
DETROIT 16, MICHIGAN

coating is removed from said first electrode means.

Washing Machine

U. S. Patent 2,698,627. *Jan.* 4, 1955. *T. J. Kearney and A. S. McPhee, assignors to Detrex Corp.*

A washing chamber for a multiple chamber washing machine comprising a main solution tank and an adjacent, flow-connected straining and screening tank; removable shed plates upon said main solution tank, disposed to prevent the flow of washing fluid into said straining and screening tank; removable straining means in said straining and screening tank; fixed screening means in said tank adjacent said main solution tank; and pumping means in said straining and screening tank convertible to operate in said main solution tank when the shed plates are in place upon said main solution tank.

Metal Stripper

U. S. Patent 2,698,781. *Jan.* 4, 1955. *W. R. Meyer, assignor to Enthone, Inc.*

The process of dissolving metals higher than hydrogen in the electromotive series of metals which includes the step of treating the metal with an aqueous strong acid solution containing a nitro-aromatic compound having a potential greater than —0.90 volt measured between a sheet-nickel electrode and a saturated potassium chloride calomel electrode under the following conditions: temperature 80° plus or minus 1° C.; pH between 8 and 13; sodium cyanide concentration approximately 2 molar and the concentration of the nitro-compound at its saturation value or about 0.25 grammol per liter of solution, whichever is the smaller.

Polishing Disks

U. S. Patent 2,698,783. *Jan.* 4, 1955. *P. L. Jones, assignor to General Motors Corp.*

A method of forming polishing discs comprising spirally winding a strip of fabric material to provide a flexible fabric ring, contracting the middle portion of said ring and closing the edges thereof to provide a flexible annular disc, dampening the inner edge of said disc with water, disposing said inner edge in a forming tool of predetermined cross-sectional configuration, applying pressure to said forming tool for compressing and compacting the fibrous structure of said ring to closely fit the surface configuration of said forming tool, and heating and evaporating said water to form steam for setting said fibrous structure to retain said cross-sectional configuration of said tool.

Gas Plating

U. S. Patent 2,698,810. *Jan.* 4, 1955. *R. A. Stauffner, assignor to National Research Corp.*

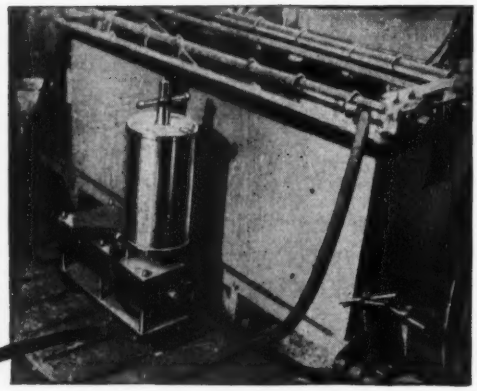
The process of coating the surface of a material with an adherent layer comprising a group VI*a* metal, said process comprising the steps of contacting said surface of said material with a mixture of a powdered inert filler material and a powdered solid carbonyl of said metal, said inert filler material being a heat insulator and having a melting point considerably higher than the decomposition temperature of teh carbonyl and being inert to said carbonyl at said decomposition temperature, said mixture comprising approximately 10% to 70% by weight of said filler material, and maintaining said surface at a temperature at least as high as the decomposition temperature of said carbonyl for a sufficient length of time to form said layer, said temperature being sufficiently low so that the carbonyl is maintained between about 130° and 180° C. so as to be below its melting point and solid carbonyl remains adjacent the surface, the total pressure over said carbonyl being maintained at about atmospheric pressure during decomposition of said carbonyl.

Hot Dip Aluminum

U. S. Patent 2,698,811. *Jan.* 4, 1955. *H. P. Legg, assignor to Kaiser Aluminum and Chemical Corp.*

The method of producing on ferrous metal a continuous coating of a metal selected from the group consisting of aluminum and aluminum base alloys, which comprises cleaning the ferrous metal, coating said cleaned ferrous metal with a continuous coating of a hydrocarbon-type wax of mineral origin adapted to burn at the melting temperature of said coating metal to produce a reducing atmosphere, and then immersing the wax-coated ferrous metal in a bath of molten metal of said group having a temperature sufficient to burn said wax thereby providing a reducing atmosphere to prevent oxidation of said ferrous metal.

CHECK the advantages



✓ of using a "Sealed-Disc" Filter

YOU'LL . . . . . be impressed too . . . . . with these proved performance features.

Models for any size or type installation in Stainless Steel, Monel Metal, Plain Iron, etc.

Small, compact — requires exceptionally small floor space coupled with remarkable filtering speed and volume.

Completely enclosed and air tight — eliminates loss of liquid from dripping.

"Sealed-Disc" Filters are complete as shown — slurry mixing tanks are not needed — filtering powders are not generally required.

Simplicity of design assures savings in operating time and labor with positive trouble-free performance.

Every plater who uses a "Sealed-Disc" Filter is impressed with it's positive, trouble-free performance.

Regardless of the size or type of your plating installation, there's a "Sealed-Disc" Filter "to fit your job" — you can depend on these proved performance features — you can be sure that all dirt, sludge, and even the invisible impurities are removed from your plating solutions.

"Sealed-Disc" Filters were designed especially to meet plating room requirements. They are smaller, more compact and portable than ordinary Filters, yet they are capable of handling equal volumes of solutions. Ask your regular plating supplier to tell you about the "Sealed-Disc" Filter that has helped so many platers get better finished plated work with savings in time and labor — or write for details.

ALSOP ENGINEERING CORPORATION

1007 Bright Street Milldale, Conn.

Other Alsop plating room equipment

We manufacture a full line of Mixers and Agitators covering a complete range of sizes, for mixing, blending and dissolving. Stainless Steel Mixing Tanks are also available in a wide range of capacities. For full details and illustrations write for your free catalogue.

ABSTRACTS

Chemical Brightening of Brass and German Silver—Composition of the Brightening Bath

G. Schmid and H. Spaehn; *Zeitschrift Metallkunde;* vol. 45, No. 6, pp. 392-397.

Details are given regarding the influence of the bath composition on the brightening results obtained in a series of investigations. The ternary systems; nitric - phosphoric - acetic anhydride; nitric-sulfuric-acetic; and nitric-phosphoric-water, were used in systematically varied ratios. The brightening results were represented as ternary diagrams at 20°, 40° and 60° C. The significance of the individual mixture components is briefly discussed. An indication is given of the important role which is played by the water in the brightening baths.

Significance of "Secondary" Inhibition for the Electroplating of Nickel

J. Elze, *Metall,* **6**, p. 500.

According to the inhibition theory of J. Fischer, with electrolytic crystal growth, temperature increase should act in the sense of reduced inhibition and increased current density in the sense of increased inhibition. This was confirmed with copper deposits by means of X-ray examination but, in the case of nickel deposition from a Watts bath, these influences were opposed to that required by the theory. It was shown that these varying effects are based on what is termed "secondary" inhibition, which is caused by the codeposition of hydrogen and the formation of basic hydrolysis products in the immediate vicinity of the cathode.

The Ematal Process

W. W. G. Huebner: *Aluminium* (Germany). Vol. 30, No. 7, pp. 283-284.

The Ematal process is an oxidic or anodic protective and processing treatment for aluminum. The basis of the process is the formation of an anodic oxide in oxalic acid. Oxalic acid coatings are superior to all other anodic coatings as regards hardness, wear resistance, thickness, and compactness. The high current densities and voltages which are commercially used with the process, amounting to 3 amp./sq. dm. and 120 volts, more than the corresponding values normally used with other anodic processes, ensure the maximum as regards the technical and commercial results possible. This improvement is increased considerably by the inclusion and deposition of titanium oxide in the anodic coating. The following data are given by the author as operating practice with the process:

Titanium-potassium oxalate	40 g./l.
Boric acid	8 "
Citric acid	1 "
Oxalic acid	1.2 "

Bath conditions:

Temperature: 55°C.

Current density: 3 amp./sq. dm.

During operation, the voltage rises from 60 volts to 120 volts within 10 minutes. The total bath processing time is 30 to 60 minutes.

Metal Polishing Compositions Containing Silicones

W. Burkart and L. Gerl: *Metalloberflaeche,* **5**, No. 5, pp. B74-B76.

Efforts are constantly being made with the object of improving the polish obtained, reducing the polishing time and lowering the polishing costs. One of the most promising lines of attack to achieve this objective is to modify the polishing pastes and compositions. Promising results have been obtained with the new wax and grease combina-

tions as the bonding agent for the polishing powder. A problem which has only been solved within recent times is to polish the metal as rapidly as possible, and this with the least possible rise in temperature of the metal. The temperatures which are occasioned on the metal surface by polishing are fairly considerable and surprisingly high. Thus, it has been established that, during the polishing of steel, the metal surface is brought up to temperatures of between 150° and 200°C. Brass and aluminum under the same conditions attain a surface temperature of over 200°C. It has been established by Bowden and Tabor that, even with polishing under moderate conditions, localized surface temperatures can reach as much as between 500 to 1.000° C. and even more, and this can suffice to cause a fusion between the metal and the grain of polishing material which has penetrated the surface. Such high temperatures, even although of extremely short duration and only at surface points, lead to changes in the surface structure and behaviour and can affect the plated metal, i.e. lead to spotting trouble etc.

The authors conducted research with the object of reducing the surface temperature during polishing, by the addition of silicone oils to standard polishing pastes. Silicone oils of varying composition and origin were added in varying amounts (from 0.01 to 5%). With these pastes, polishing tests were conducted on steel, brass, an aluminum-magnesium-silicon alloy, chrome and nickel plated under conditions which, as far as possible, were kept the same. The first fact found was that the silicone addition, when it exceeded a certain limit, acted rather in a disadvantageous manner. It was further found that only a special silicone oil is suitable for this duty. The polished test pieces, after careful cleaning, were measured with the universal surface test measuring equipment of Dr. B. Lange. The polishing results are given in the following table. The average values (A) obtained with a suitable combination are shown in comparison with the same polishing pastes without silicone oil addition (B).

TABLE I

	Brass	*Steel*	*AlMgSi*	*Chromium*	*Nickel*
A	63	49	63	48	48
B	57	40	53	47	45

As is shown by the polishing values, with a suitable silicone oil addition to the polishing pastes, the brilliance of a metal surface can be increased by a certain amount. Regarding the effect of the silicone oil addition on the behaviour of the paste during the polishing, it was observed in the laboratory and this was confirmed under practical polishing conditions, that the silicone-containing polishing pastes had the characteristic, when applied to the polishing disc, of spreading more uniformly over the surface. A definite high brilliance is also obtained more rapidly with the silicone-containing pastes. The polishing times are given in Table II which represent the average of a series of polishing time counts after which a certain brilliance is obtained on the polished metal surface. Series A is with silicone addition, series B without the addition. The brilliance figures of series A were almost entirely above those of series B.

TABLE II

Polishing Time in Seconds

	Brass	*Steel*	*AlMgSi*	*Chromium*	*Nickel*
A	34	40	40	62	23
B	43	50	49	64	30

The higher brilliance obtained by the polishing and the shorter polishing time required by the silicone oil addition to the paste is ascribed to modification of the surface tension of the molten wax and grease in the paste during polishing by the silicone, which enables the polishing grit more effectively to do its work.

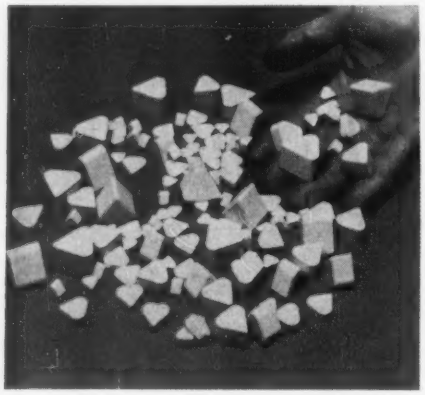
362
COMPANIES
USE
Sel-Rex
Bright Gold Process
More and more manufacturers have recognized the need for adding "sales appeal" to their products and they have found the answer with the Sel-Rex BRIGHT GOLD PROCESS . . . without increasing their manufacturing cost!
Here is the only Bright Gold Process that offers unlimited use — both decorative as well as functional. It produces a rich, mirror-bright surface that is hard and corrosion resistant without scratch brushing or buffing. Sel-Rex BRIGHT GOLD PROCESS requires no special equipment and operates at room temperatures.
Let us demonstrate how the Sel-Rex BRIGHT GOLD PROCESS can improve your product . . . help create greater sales appeal — at lower cost. Try a trial order or write for complete data to meet your particular specifications.
Sel-Rex Precious Metals, Inc.
220 MAIN STREET BELLEVILLE 9, NEW JERSEY
Manufacturers of Sel-Rex Silver Sel-U-Salt and Bright Rhodium
Automotive
Pens and Pencils
Household Appliances
Watches and Jewelry
Accessories

Recent Developments

NEW METHODS, MATERIALS AND EQUIPMENT FOR THE METAL FINISHING INDUSTRIES

Barrel Finishing Media

Crown Rheostat & Supply Co., Dept. MF, 3465 Kimball Ave., Chicago 18, Ill.



Crown Pebs, the triangular shaped, ceramic, barrel tumbling media, are now available in a new smaller size, according to information released by the manufacturer. This new small-sized peb considerably extends the range of usefulness to which they may be applied. Using the new smaller size, fine finishing work can be more easily accomplished.

The addition of this smaller size now makes the product available in a complete range of sizes, for many different deburring and finishing applications. By selecting the proper size, the "lodgement" hazard, encountered when conventional random shaped natural or synthetic stone chips lodge in holes and slots, is eliminated. This also eliminates the necessity for an extra operation to remove the lodged material.

The company states that the tough wear resisting ceramic used in the manufacture insures a service life several times longer than either natural stones or aluminum oxide type of tumbling chips. Because of their uniform size and shape, the material can be quickly and easily screened to separate one size from another, or to separate them from the work being processed.

Acid Copper Brighteners

Electroplating Projects Dept., Westinghouse Electric Corp., Dept. MF, P.O. Box, 2009, Pittsburgh 30, Pa.

Two new organic addition agents for use in acid copper sulfate electrolytes are now available.

The first, Wes-X 303 acid copper addition agent, is for heavy build-up applications and was specifically designed for plating record stampers, rotogravure rolls, electrotypes and other electroformed shapes. With the new addition agent it is possible to obtain smooth, dense copper deposits with an exceptionally fine-grained structure and plating speeds can be increased with freedom from nodule formation and treeing. These advantages can be realized without adverse effect upon other physical characteristics of the deposit, according to the company.

The second, Wes-X 304 acid copper addition agent permits the economical deposition of bright, ductile copper for decorative purposes. The deposit is characterized by a high degree of leveling and grain refinement. The new addition agent makes possible wider bright plating ranges and use of higher current densities over an extended temperature range.

With either addition agent, solutions may be controlled readily by simple plating tests.

Safety Solvent

Turco Products, Inc., Dept. MF, 6135 South Central Ave., Los Angeles 1, Cal.

Improved Turco-Solv incorporates an outstanding new development in the formulation of safety solvents. The new material offers greatest possible solvency for faster, most effective removal of grease, oil and carbon film, yet it is non-explosive, non-flammable (flash point over 200°F., TCC), and safer than dangerous carbon tetrachloride.

The solvent combines the least toxic solvents available, consistent with safety from fire hazard. It contains neither carbon tetrachloride, nor any of the highly toxic chlorinated solvents.

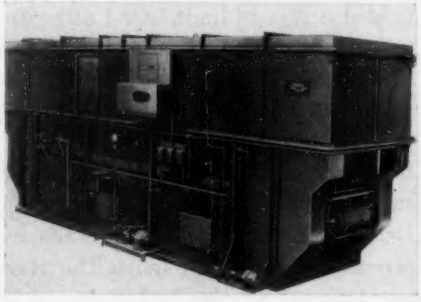
Ultrasonic Degreasers

Circo Equipment Co., Dept. MF, 138 Central Ave., Clark (Rahway) N. J.

New low frequency flat-type transducers developed for Circosonic ultrasonic metal degreasing equipment improve the efficiency of ultrasonic cleaning methods and greatly extend the size of workpieces that can be handled, it is claimed.

Low ultrasonic frequencies have greater penetrating ability and therefore greater cleaning efficiency than the higher frequencies previously employed. In the new equipment, low frequency ultrasonic waves, generated by barium titanate transducers of new design, are stated to freely curve around corners and sharp angles, and to penetrate more easily into recesses and capillaries to remove all dirt, oil, grease, chips and lapping compound from the article to be cleaned.

The flat shape of the transducers



permits them to be teamed to any length or width for cleaning large shapes such as transmission pumps and gears. Because sound energy is beamed over a wider area, small parts like bearings and electronic components can now be cleaned ultrasonically without requiring critical positioning.

Redesign of the barium titanate

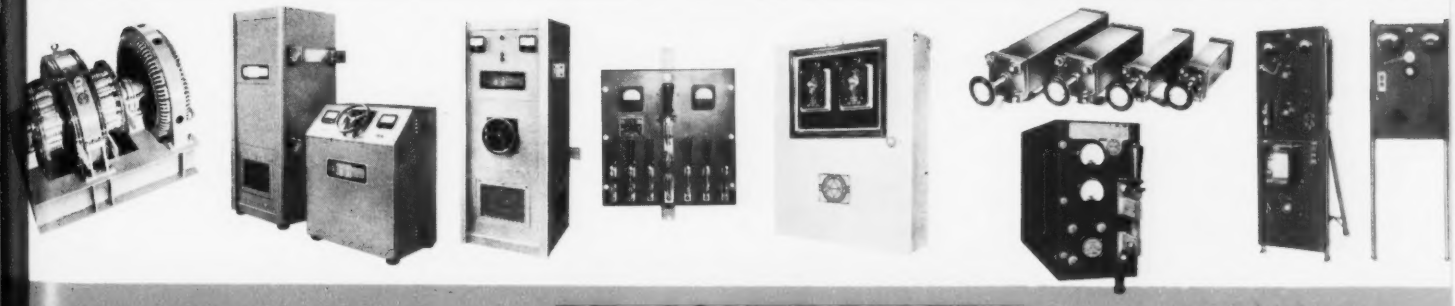
BULLETIN DC-102

For every DC electrical requirement in metal finishing...

H-VW-M

The *only* manufacturer with a *complete* line of

GENERATORS
SELENIUM RECTIFIERS
GERMANIUM RECTIFIERS
RHEOSTATS



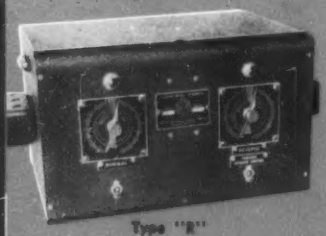
PR CONTROLLERS
SPECIAL PANELS

HANSON-VAN WINKLE-MUNNING COMPANY
MATAWAN, NEW JERSEY

Manufacturers of a complete line of electroplating and polishing processes, equipment and supplies
Plants: **Matawan, New Jersey • Grand Rapids, Michigan**

Sales Offices: Anderson (Ind.) • Baltimore • Beloit (Wisc.) • Boston • Bridgeport Chicago • Cleveland • Dayton • Detroit • Grand Rapids • Los Angeles • Louisville Matawan • Milwaukee • New York • Philadelphia • Pittsburgh • Plainfield (N. J.) Rochester • St. Louis • San Francisco • Springfield (Mass.) • Utica • Wallingford (Conn.)

AND FOR OTHER DC APPLICATIONS...



Type "R"

H-VW-M PR CONTROLLERS—for periodic reversal of direct current for the H-VW-M PR and Wes-X Bright Copper Process and similar processes.

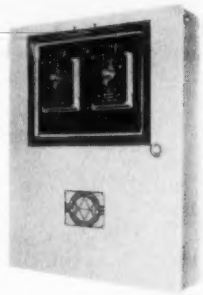
Type "R"—for reversing fields of a single generator.

Type "RM"—for reversing fields of 2 or 3 generators simultaneously.

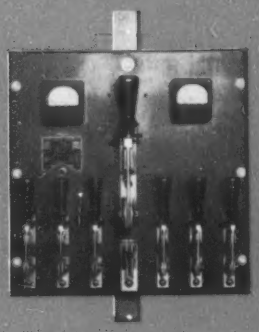
Type "RS"—a sub-controller, same Type "RM" except no timers.

Type "RL"—for line reversal with rectifiers or single tanks on branch circuits.

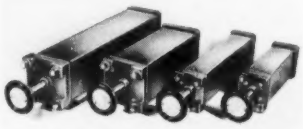
Write for complete information.



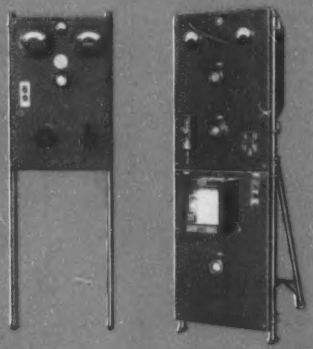
Type "RMH"
(special heavy duty Type "RM")



H-VW-M TANK RHEOSTATS—Furnish desired current density for plating by introducing a definite voltage drop between main lines and tank rods to produce the required voltage between anode and cathode. Standard ampere ratings from 30 to 1000 amperes (larger sizes to 5000 amperes on special order). *Ask for Bulletin TRA-527.*



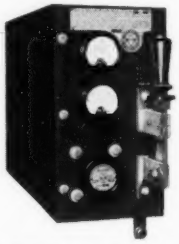
H-VW-M CARBON PILE RHEOSTATS—For precise stepless control on DC circuits. Rated from 25 to 250 amps. on continuous service; resistance range up to 50 to 1. *Ask for Bulletin CPR-100.*



Standard Generator Control Panel

Automatic Anodizing Control Panel

H-VW-M SPECIAL PANELS—Standard control equipment includes: DC Voltmeter; DC Ammeter with separate shunt; generator field rheostat; exciter field rheostat (or resistor); DPST field switch with discharge resistance (when required); start-stop push-button station for motor starter; motor field resistor and motor field ammeter (on synch. motor-driven sets only). Full line of auxiliary equipment available. *Send for Bulletin G-103.*



H-VW-M UNIVERSAL CARBON PILE TANK RHEOSTATS—Combine stepless, infinite control characteristics of carbon pile rheostat with adjustable nickel-chromium resistor. Combination provides ALL tank voltages for a specified line voltage and maximum amperage condition. *Send for Bulletin CPR-200.*

Engineered A COMPLETE LINE OF **ELECTROPLATING AND POLISHING PROCESSES, EQUIPMENT & SUPPLIES**

H-VW-M PRODUCTS AND PROCESSES

Abrasives
Acid Pump
Ammeters
Analyses, Solutions
Anodes
Anode Bags
Anode Containers, Ball
Aprons, Platers'
Balls, Steel Eclipse
Barrels, Burnishing
Barrels, Tumbling
Barrels, Plating
Barrels, (Portable Burnisher and Dryers)
Basket, Scrap Anode
Baskets, Dipping
Brighteners, Addition Agents
Brushes
Brush Units (Helical)
Buffs
Cathode Rockers
Chemicals, Plating
Chrome Spray Floats
Chrom-flo Anodes
Cleaners—and Solvents
Compounds
Conveyors, Full Automatic
Conveyors, Semi-Automatic
Conveyors, Skip-Stop
Cooling Coils
Crocks, Earthenware
Degreasing Solvents
Dryers
Exhaust Fans
Filters
Felt
Fluxes
Generators
Gloves, Platers'
Glue, Belgrade
Heaters
Heating Coils
Hose
Insulating Steam Joints
Klinch Grain Cement & Thinner
Kote-Masq
Kote-Rax, Grade M
Lathes
Lime
Moisture Extractor Equipment
Pails, Rubber
Paint, Tygon Plastic
Periodic Reverse Control
Pipe & Fittings, BN
Purification Supplies
Rectifiers, Germanium
Rectifiers, Selenium
Rheostats, Carbon Pile
Rheostats, Tank
Rheostats, Universal Carbon Pile
Salt Fog Corrosion Testing Equip.
Sisalin Sections
Bias Sisalweev Sections
Standard Plating Solutions
Tank Rheostats
Tanks
Temperature Controllers
Triclene "D"
Voltmeters
Wheels, Polishing
Wrap-Rax Tape
Continuous Strip and Wire Cleaning, Plating and Pickling Lines

HANSON-VAN WINKLE-MUNNING CO. MATAWAN, NEW JERSEY, U.S.A.

H-VW-M

HANSON-VAN WINKLE-MUNNING COMPANY, MATAWAN, N. J.

PLANTS: MATAWAN, N. J. • GRAND RAPIDS, MICHIGAN

SALES OFFICES: ANDERSON (IND.) • BALTIMORE • BELOIT (WISC.) • BOSTON • BRIDGEPORT CHICAGO • CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • LOS ANGELES LOUISVILLE • MATAWAN • MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH PLAINFIELD (N. J.) • ROCHESTER • ST. LOUIS • SAN FRANCSCO • SPRINGFIELD (MASS.) UTICA • WALLINGFORD (CONN.)

Printed in U.S.A.

INDUSTRY'S WORKSHOP FOR THE FINEST IN PLATING AND POLISHING PROCESSES • EQUIPMENT • SUPPLIES

crystal transducers permits them to be driven at higher watt densities, so that the sound waves need no longer be focussed to produce adequate intensity of cavitation. As a result, it has been feasible to use flat transducers in production model ultrasonic cleaners.

The new transducers are now available as standard equipment in 500 watt, 2 kw., 10 kw., and 25 kw. ultrasonic units, each comprising an ultrasonic generator and an ultrasonic chamber. Units are available separately or integrated with conveyorized or hand operated vapor degreasers. The conventional equipment removes the heavy contaminants while the ultrasonic unit scrubs out all remaining dirt to meet the most stringent industrial or military standards. Ultrasonic chambers may also be integrated into existing degreasing machines with liquid immersion stages.

Chromic Acid Spray Control

Smoothex, Inc., Dept. MF, 10705 Briggs Road, Cleveland 11, O.

Plating plants and manufacturers of parts, who operate their own plating departments, can now control chrome spray by dropping a few Smoothex Anti-Fume pellets into their plating baths.

Determination of the number of pellet additives to be placed into a plating bath for an initial charge is made simple. Since each pellet weighs exactly one-ounce, the operator need only count out 72 pellets to make up a four-pound charge for a 100 gallon tank. Thus, no weighing of the pellets is necessary.

Because of an exceptionally long life, the pellets are economical to use, according to the manufacturer. A few pellets, dropped into a plating tank bath, immediately go into action. Each pellet tends to keep the chromic acid in the bath preventing the escape of fumes, spray and dragout. The pellets will not break down under normal plating operation. They are so stable that once a tank is charged, the occasional addition of a few pellets, in the bath, is all that is necessary to maintain reduced surface tension.

The anti-fume pellets are also claimed to reduce heating costs, improve the rinsing and drying operation and lower tank contamination.

Feedwater Heater

Graver Water Conditioning Co., Dept. MF, 216 W. 14th St., New York, N. Y.

A new, small size, compact deaerating heater is designed specifically for use in small plants where economy and space requirements are of prime importance. The low initial cost, minimum maintenance, and limited headroom needs of the SSC Deaerating Heater make it ideal for such use.

Corrosion and pitting of boiler tubes, condensate return lines, and accessories is usually caused by the presence of non-condensable gases such as oxygen and carbon dioxide in the feedwater. The deaerating heater, while heating the feedwater to the temperature of the operating steam, accomplishes their removal. In addition, since steam is used in the deaera-

GRIND
POLISH
BUFF
DEBURR
with a Hammond
ROTARY AUTOMATIC

SEND SAMPLES
and we'll show you how much you can speed production and cut costs.

Model "K" Hammond Automatic Finishing Machines are made in 34", 46" and 62" table sizes. These models are either continuous or for indexing at 150 to 1700 indexes per hour. Head styles include floating, non-floating with 3 H.P. to 20 H.P. range. Also available are attachments for converting heads from buffing to abrasive belt polishing. The Hammond Model "K" will speed up your grinding, polishing, buffing, brushing and de-burring operations. Send us samples and learn how much you can speed them up.

Hammond Machinery Builders INC
1601 DOUGLAS AVENUE KALAMAZOO, MICHIGAN
See us at booth 214 the Machinery Exposition, Chicago Coliseum, Sept. 6-17

tion process, plants can utilize exhaust steam or reduced pressure make-up steam for this purpose. Recovery of waste steam for use in the heater prevents loss of thermal energy and results in appreciable fuel savings. The new heater is a two-stage, spray type heater containing an internal vent condenser of stainless steel.

The heater is easily installed and comes completely equipped with all accessories in a wide variety of sizes.

Carbonate Remover

Westinghouse Electric Corp., Electroplating Projects Dept., Dept. MF, P.O. Box 2099, Pittsburgh 30, Pa.

A new carbonate remover, Wes-X 150, has been developed for use in any proprietary alkaline cyanide plating process in which removal of carbonates is desirable. The new material precipitates carbonates in exchange for cyanide ions. It also assists in the elimination of certain contaminants.

Representing a new approach to the control and maintenance of alkaline cyanide plating processes, the new carbonate remover can be used in conjunction with hydrated lime to maintain optimum concentrations of hydroxide and free cyanide without alkali metal cyanide or hydroxide additions. It is an ideal source of cyanide ions when complexing metal cyanides in both sodium and potassium types of plating solutions.

Use of the new product can also eliminate the necessity for batch treating the entire solution. Only a small portion of the solution requires treatment at one time.

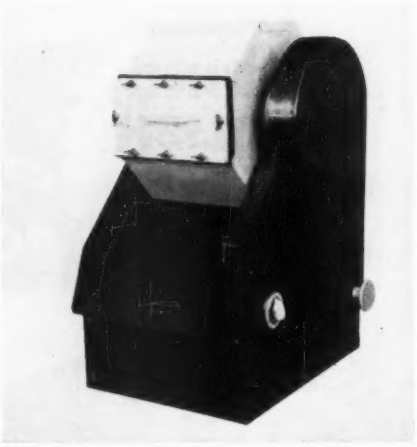
The new carbonate remover is supplied in metal drums in formulations for either sodium or potassium solutions.

Tumbling Barrel

Mido Products, Dept. MF, 1801 Border Ave., Torrance, Cal.

The new bench mounted tumbling machine for small parts has been developed with an eye to the future and as a result of miniaturization in many fields of industry. The unit does not leak, an important factor when tumbling precious metals where slurry is refined.

The model illustrated has timer, lining for wet tumbling, and single speed of 38 r.p.m., with dump chute for unloading. Units are also available



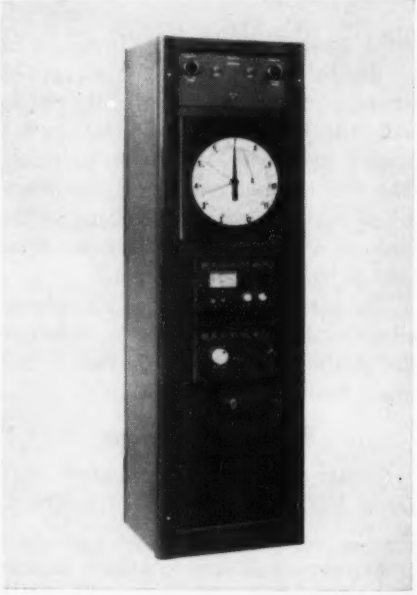
with three speeds (16-27-44 r.p.m.) at slightly higher cost.

The unit plugs into any 110 volt outlet. It is powered with a ⅓ h.p. single phase motor. Drive is through "V" belts with allowances for belt stretch. Barrel size is 10″ x 14″. Space required measures 18″ x 20″. Construction is of 18 gauge steel welded angle iron frame. Barrel is 16 gauge steel spot welded around sides and welded to opening frame of ¼″ steel plate. The machine is finished in grey blue hammertone and safety yellow. Maintenance of unit consists of oiling every six months.

Factory Packaged pH System

Beckman Div., Beckman Instruments, Inc., Dept. MF, Fullerton 1, Cal.

Designed for use in any pH process application, these "packaged" pH control systems combine in a single unit all the components needed for single or multiple-channel pH process monitoring, recording and controlling. The



entire system is built at the factory, wired, piped and assembled ready for plug-in installation. The basic components can be assembled into a number of different combinations from the simple combination of pH meter and alarm to the multiple-channel monitor-recorder-alarm-control system.

New Type Silica

Tamms Industries, Inc., Dept. MF, 228 N. LaSalle St., Chicago 1, Ill.

The above manufacturer has just announced a newly developed, soft, amorphous type silica which should be of special interest to metal finishers. It is known as Dustex Micro-Silica, has a particle range of 1 to 15 microns (98% minus 10 microns) and, according to the company, has a number of superior features. In addition to the increased surface area, the material has a low pH value and higher oil absorption. New and improved manufacturing equipment has been installed to assure consistently high quality and positive production control.

Corrosion-Proof Flooring Material

The Ceilcote Co., Inc., Dept. MF, 4908 Ridge Road Cleveland 9, O.

Coro-Crete, a new corrosion proof floor material, is claimed to provide increased protection from attack by alkalis, solvents and acids. Developed for application directly over concrete the new material is composed of three basic ingredients: (1) a thermosetting resin liquid, (2) a hardening agent and (3) an aggregate-type filler.

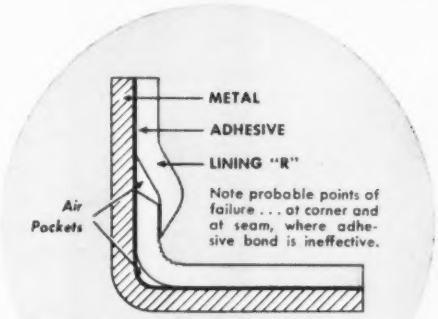
The material handles like cement topping and is applied in thicknesses from ¼-inch minimum to ⅜-inch maximum (per layer). Unlike cement, however, it cures in only a few hours time to a dense, impermeable and non-dusting surface. Because of its quick curing qualities, it is especially useful when minimum plant "downtime" is important.

This new corrosion-proof material is recommended for existing as well as new concrete floor surfaces. Adhesion to concrete is excellent and installation data indicates that the bond to concrete is stronger than the concrete itself. In addition, Tabor abrasion tests show the surface to be two to four times more resistant to abrasion than most concrete floors. Its physical strength is approximately four times greater than concrete, it is claimed.

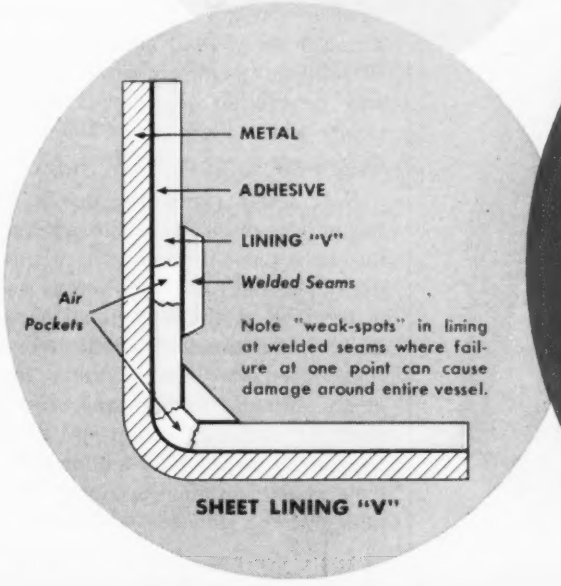
For positive protection against chemical attack, specify*

A and P FINISHING TP-111

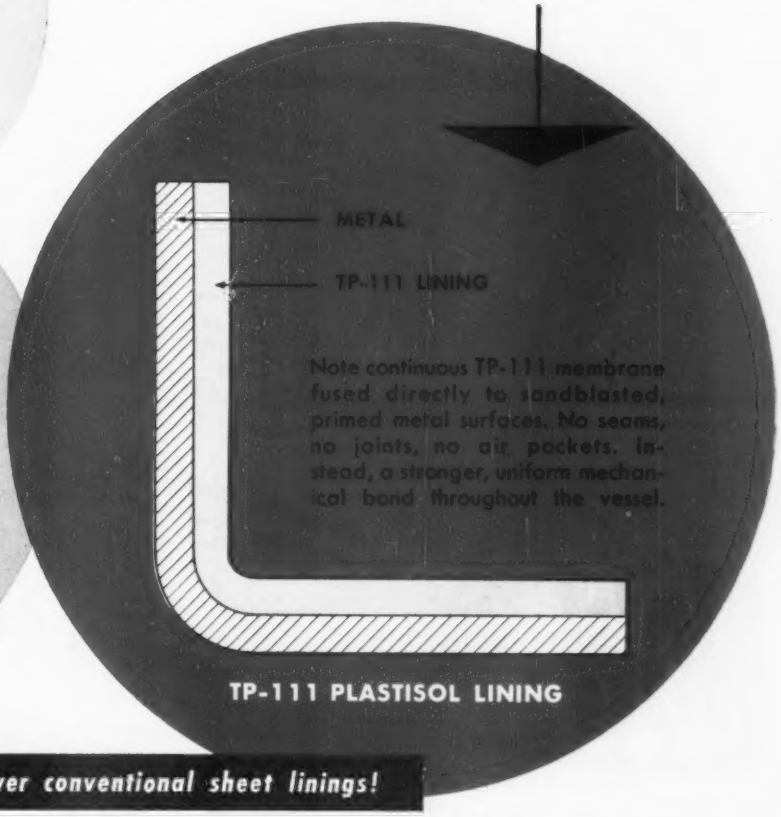
the improved sprayable plastisol that forms a continuous, seamless protective lining fused directly to the primed metal surfaces of your plating and processing equipment


METAL
ADHESIVE
LINING "R"
Air Pockets
Note probable points of failure . . . at corner and at seam, where adhesive bond is ineffective.

SHEET LINING "R"


METAL
ADHESIVE
LINING "V"
Welded Seams
Air Pockets
Note "weak-spots" in lining at welded seams where failure at one point can cause damage around entire vessel.

SHEET LINING "V"


METAL
TP-111 LINING
Note continuous TP-111 membrane fused directly to sandblasted, primed metal surfaces. No seams, no joints, no air pockets. Instead, a stronger, uniform mechanical bond throughout the vessel.

TP-111 PLASTISOL LINING

Compare the advantages of TP-111 over conventional sheet linings!

- **CONTINUOUS MEMBRANE**—As applied by A & P Finishing specialists, TP-111 forms a continuous membrane lining completely free of the joints, seams, and air pockets normally found in conventional sheet linings. Such breaks in a lining are generally considered weak spots where failure would permit liquid to flow to various parts of the vessel, causing extensive damage and loss of current density.

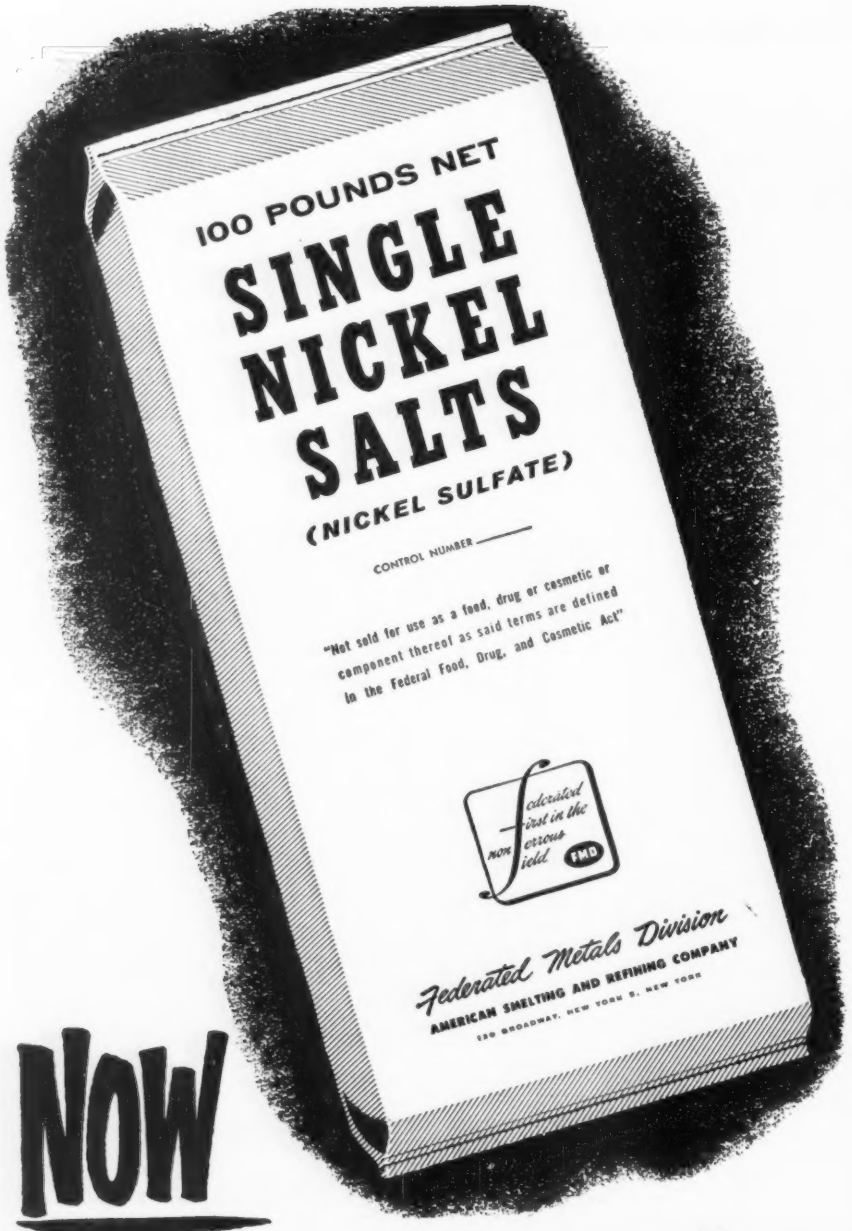
- **STRONGER BOND**—A & P Finishing TP-111 is fused directly to primed, sandblasted metal surfaces . . . thus effecting a stronger mechanical bond than that produced by adhesives used with conventional linings. This also permits use of TP-111 on higher temperature applications where adhesives are apt to soften causing a separation of the sheet lining from the base metal. Further, in the event of accidental damage to the TP-111 lining, chemical attack and undercutting is localized.

- **CONTROLLED HARDNESS**—The film hardness of TP-111 can be controlled to meet individual job requirements by A & P Finishing specialists. In addition, greater chemical and abrasion resistance can be effected through formulation and curing techniques which produce an unusually dense and durable membrane.

* ***POSITIVE PROTECTION*** — Protective linings are only as effective as the method by which they are applied. That's why it pays to insist upon proven A & P Finishing TP-111 linings as installed in our plant by workmen recognized as pioneers in this field. All work guaranteed and surprisingly low in cost. Available, too, through equipment manufacturers and plating jobbers. Write for details today!

A and P FINISHING AND MANUFACTURING CO.

17760 CLARANN AVENUE
MELVINDALE (Detroit) MICHIGAN
***Telephone* WArwick 8-7515**


100 POUNDS NET
SINGLE NICKEL SALTS
(NICKEL SULFATE)
CONTROL NUMBER
"Not sold for use as a food, drug or cosmetic or component thereof as said terms are defined in the Federal Food, Drug, and Cosmetic Act"
Federated first in the non ferrous field
FMD
Federated Metals Division
AMERICAN SMELTING AND REFINING COMPANY

NOW

from Federated!

Federated Metals is now supplying top quality domestic nickel salts. These are made by Federated under consistent quality control that assures you full nickel content and identical plating characteristics from every lot. Try Federated nickel salts. Call the nearest Federated office for the name of the Federated Distributor in your territory.

Try Federated, too, for all your plating anodes: Lead—including our famous Conducta-Core anode—Cadmium, Zinc, Brass, Copper, Tin and Tin-Lead. All sizes and shapes are available from Federated or from specialized distributors in your area.

Federated Metals

DIVISION OF AMERICAN SMELTING AND REFINING COMPANY
120 BROADWAY, NEW YORK 5, N. Y.
IN CANADA: FEDERATED METALS CANADA, LTD., TORONTO AND MONTREAL

Federated first in the non ferrous field FMD

Aluminum, Anodes, Babbitts, Brass, Bronze, Die Casting Metals, Lead and Lead Products, Magnesium, Solders, Type Metals, Zinc Dust

Demineralizer

Penfield Mfg. Co., Dept. MF, 19 High School Ave., Meriden, Conn.

The above manufacturer has announced the addition to its line of industrial demineralizing equipment of a new, completely automatic mono-column demineralizer designed for users of 200 G.P.H. of super high purity water.

The new demineralizer is an exceptionally compact, completely packaged unit, requiring for its installation a minimum of floor space, connection of influent to a plant's water system, and connection of effluent to those points where high purity water is required (process, boiler feed, etc.).

Raw water enters the demineralizing unit at the influent and after passing only once through the mono-column of mixed cation and anion resins, is received at the effluent stripped of all its impurities. A flow meter on the influent enables setting water intake at an optimum rate for the most efficient ion exchange action and an electric purity meter plus automatic controls enable automatic control of the purity of the effluent.

There are no valves to operate and minimum supervision is required. Whenever the effluent's conductivity falls below standard, the treated water is automatically discharged and lights (or other warning system) signal the need for activation of a regeneration cycle. The simple turn of a single switch then puts the unit through its regeneration cycle automatically, including rinsing and recutting in the effluent when desired resistivity (purity) is reached. During this automatic regeneration cycle, the regenerative tanks are automatically refilled with water so that fresh acid and caustics may be added in preparation for the next regeneration cycle.

Cleaner-Stripper Compound

Chemclean Products Corp., Dept. MF, 610 Warren St., Brooklyn 17, N. Y.

Du-Al No. 489, a new, unique multi-

purpose alkaline compound that removes rust, scale, paint, grease, oil, etc. in one operation has been developed by the above manufacturer. Advantages claimed are:

1. Non-corrosive to sound ferrous metals.
2. Can be used as a soak or electrolytically with reverse or direct current.
3. Eliminates the possibility of hydrogen embrittlement caused by acid descaling.
4. Eliminates the need for acid pickling in rust removal.
5. Eliminates acid disposal problems.
6. It is economical and long lasting.
7. It can be used in a mild steel tank.
8. It performs several important functions in one operation and incorporates many advantages not found in any product now on the market.

Contour Polishing Wheel

Behr-Manning Div., Norton Co., Dept. MF, Troy, N. Y.

A basic improvement in automatic metal polishing and a spectacular reduction in polishing costs are claimed with the introduction of a new type of wearable coated abrasive contour wheel.

The new Kon-Toor is substantially an all-coated abrasive wheel, and thus is capable not only of being shaped to the work, but also of holding that shape as it wears. Designed for use on straight-line and rotary automatic polishing equipment, it is equally

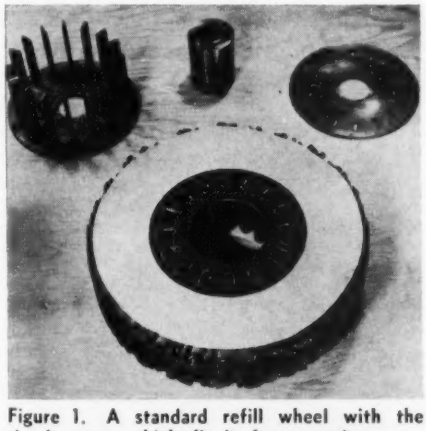


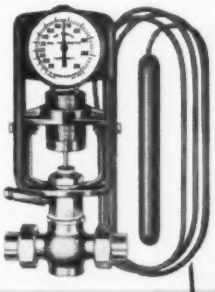
Figure 1. A standard refill wheel with the simple parts which fit it for mounting on a drive spindle. Clockwise, these include the cage with its 16 elliptical tubes which engage the folded packets of coated abrasives; the correct size of bushing to fit the drive spindle; and the side plate. In use, the assembly is held in place by the conventional washer and nut. The canvas side shield reduces wind and noise.

GOLD
is costly to plate
DON'T WASTE IT!

Even with traps installed to recover gold, you're *wasting* it...

IF you have to replate frequently
IF solution decomposes
IF there is excessive evaporation

Correct temperature regulation will help eliminate this loss of valuable gold, time and labor.



install Powers

AUTOMATIC TEMPERATURE CONTROL
for All Metal Finishing Processes

For plating tanks and other metal finishing processes. Powers Controls quickly pay back their cost by accurately holding solutions at a constant uniform temperature.

Write for Bulletin 330

4

POWERS

TECHNICAL DATA SHEET

GOLD

IF you plate—GOLD

Too high a temperature can result in:

1. Excessive build up of carbonates.
2. A tendency to spongy deposits.
3. Excessive evaporation.
4. Color variance.
5. Low cathode efficiency.

Too low a temperature can result in:

1. A low limiting current density.
2. Pale deposits.
3. Dark deposits.
4. Inclusion of foreign metals in the deposit (lower carat).

THE POWERS REGULATOR COMPANY

Skokie, Ill. • Offices in Chief Cities in U.S.A. and Canada • See Your Phone Book

(c32)

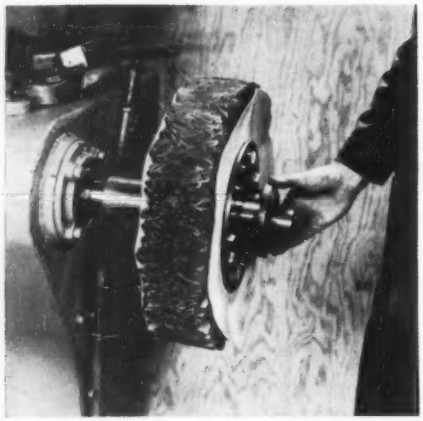


Figure 2. With the correct bushing installed, conversion to the new wheel is simplicity itself.

adaptable to semi-automatic fixtures where it requires no special attachments or other accessory equipment.

Construction is unique but simple. The hub is a rugged steel cage whose side flanges are joined by 16 rods, each supporting an elliptical tube. These tubes hold U-shaped packets of folded, coated abrasive sheets with grain on both sides. Bushings are provided to fit standard -drive spindles. Canvas side shields, which reduce wind and noise generated by the relatively open construction, complete the assembly.

Wheels are 17 in. in diameter, and from 2 to 7 in. in width. For greater widths, wheels may be ganged. Performance is maintained unimpaired throughout the life of the wheel, and replacement wheels are available for ready mounting on the original cage or hub. Abrasive cloth used is Durite (silicon carbide) or Metalite (aluminum oxide) in a grit range of from 120 to 400. Recommended wheel speeds range between 1500 and 2400 r.p.m., although variations in speed have less critical results than with conventional contact wheels or belts.

Designed for standard spindle mounting, the wheel can instantly replace a set-up wheel, wire brush compound wheel or buffing wheel, without change of safety guards, backstands or motor speeds.

In use, the wheel applies almost unbroken abrasive contact to the work, as opposed to the slapping action hitherto available in abrasive wheel designs. This smooth polishing action is a major reason for the superlative finishes which the wheel affords. Flexibility of the wheel as a whole is varied by using single- or double-folded cloth.

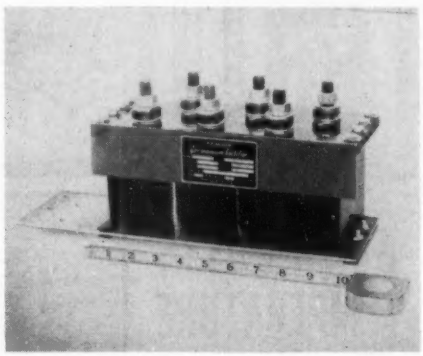
Simple, slight contours may be polished with the wheel as delivered. To polish sharp angles or complex contours, the face of the wheel is dressed to the contour. Where the contour must be precise, a profile gage is used to transfer the contour of the work piece to a wooden block; the block, faced with coarse sandpaper, is then used to dress the wheel accurately.

The new wheel is fundamentally a polishing tool; as in the past, removal of weld marks and other major imperfections should be done by the usual coated abrasive belt method.

Germanium Power Rectifiers

International Rectifier Corp., Dept. MF, El Segundo, Cal.

These diffused junction germanium rectifiers are recommended by the above manufacturer for AC to DC power conversion where high power output, high efficiency, no aging and



small unit size are required. By careful selection of junction characteristics and propitious circuit design, germanium junction rectifiers can be supplied for voltage ranges from 10 V to 100 KV and from 10 amps. to 100,000 amps. by connecting junctions and assemblies in series or parallel.

The photograph shows a fan cooled germanium unit, rated 750 amps. at 40 V output in a three phase, half wave circuit.

The improved rectifier design provides for superior cooling efficiency and a more compact unit assembly. Unlimited operating life can be expected over a temperature range of -55°C. to plus 75°C. maximum when equipment is designed to operate within specified voltage, current and temperature rise ratings. This temperature range provides ample safety factor for all normal industrial and commercial applications.

The rectifiers are available in three styles: natural convection, forced convection and liquid cooled.

Resin Coating Trial Kit

Corrosion Engineering Dept., Pennsylvania Salt Mfg. Co., Dept. MF, 3 Penn Center Plaza, Philadelphia 2, Pa.

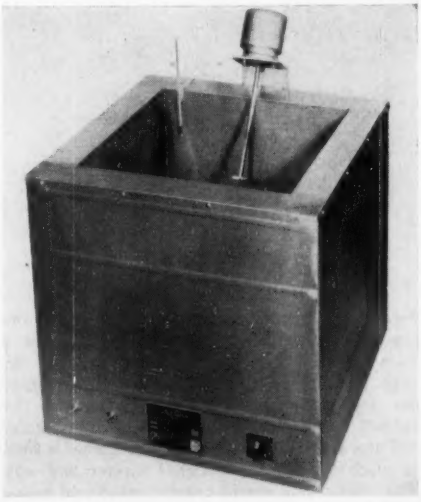
A low cost trial kit of Thick-Coat, the company's new resin coating product for humid and corrosive atmospheres, designed for testing purposes, contains one quart of Pennsalt Lock Prime, a quart of Pennpaint thinner, complete specifications and directions for use.

The system provides a durable protective coating for new or corroded metal, concrete and wood surfaces exposed to fumes, corrosive atmospheres and spillage of destructive chemicals. It has excellent flow qualities and is applied like regular maintenance paint by brush, roller or spray as it comes from the can. In a three-coat system—one primer and two top coats—it will build up to a minimum of 6 mils dry film thickness. Containing over 60% solids by weight, it assures long-lasting protection on edges, prominences and crevices, as well as on plane surfaces. The material is regularly offered in white, green, slate gray, silver gray, and black and may be obtained in other colors on special order.

High Temperature Bath

Labline, Inc., Dept. MF, 217 N. Desplaines St., Chicago 6, Ill.

A new high temperature (450°F.) bath is stated to be suitable for all types of high temperature testing and other operations. Made with double-wall insulated construction, the bath has built-in heaters, adjustable thermostat and induction type motor stirrer.



Uniformity and sensitivity of control is ±1°.

Interior and exterior is 18-8 stainless steel. All seams are electrically welded. Thermo-regulator is hydraulically operated. Interior dimensions are 18" x 18" x 15" deep.

Ultrasonic Descaling and Plating

The General Ultrasonics Co., Dept. MF, 1240 Main St., Hartford 3, Conn.

Two new industrial processes using ultrasonic vibrations in liquids have been announced. The Sonistrip process greatly accelerates and improves the efficiency of pickling and descaling of metals in acids and caustics, according to the company. Welded stainless steel Sonicells, impervious to most corrosive fluids, are immersed in acid or caustic solutions and radiate ultrasonic vibrations at 19,800 cycles per second. This greatly accelerates the pickling and cleanup effects of the solutions due to ultrasonic "cavitation." Rust, oxide and scale removal are accomplished in 10 to 90 seconds compared with 10 minutes to one hour by previous methods. Interior surfaces and deep crevices are pickled or descaled in the same short time as outer surfaces.

The Soniplate process accelerates and improves electroplating and electroless plating by introducing ultrasonic vibrations into the plating bath. If required by the characteristics of the solution, the stainless steel transducer cells can be further protected by resin coating. The vibrations and accompanying "cavitation" cause rapid replacement of the exhausted or saturated liquid layers ordinarily surrounding anode and cathode, and increases of 2 to 100 times in plating current density without "burning" have been noted. Edge build up is eliminated or minimized, throwing power is increased, anode polarization is eliminated, grease, rust or dirt which may have remained on the work due to imperfect precleaning are simultaneously removed by ultrasonic action, and the result is better plating and fewer rejects, it is claimed.

The transducer cells are installed one to each square foot of tank side or bottom area and can, therefore, be arranged as necessary for use in new or existing tanks of any size. For

a special message for appliance manufacturers
need a finish that blocks corrosion by itself—or under paint?
specify IRIDITE

You can solve any problem of non-ferrous finishing . . . maximum corrosion protection . . . sparkling clear or colored decorative finishes, firm and lasting base for paint . . . with these two words—"specify Iridite". For example—

- **ON ZINC AND CADMIUM** you can get highly corrosion resistant finishes to meet any military or civilian specifications and ranging in appearance from olive drab through sparkling bright and dyed colors.
- **ON COPPER . . .** Iridite brightens copper, keeps it tarnish-free; also lets you drastically cut the cost of copper-chrome plating by reducing the need for buffing.
- **ON ALUMINUM** Iridite gives you a choice of natural aluminum, a golden yellow or dye colored finishes. No special racks. No high temperatures. No long immersion. Process in bulk.
- **ON MAGNESIUM** Iridite provides a highly protective film in deepening shades of brown. No boiling, elaborate cleaning or long immersions.

AND IRIDITE IS EASY TO APPLY. Goes on at room temperature by dip, brush or spray. No electrolysis. No special equipment. No exhausts. No specially trained operators. Single dip for basic coatings. Double dip for dye colors. The protective Iridite coating is not a superimposed film, cannot flake, chip or peel.

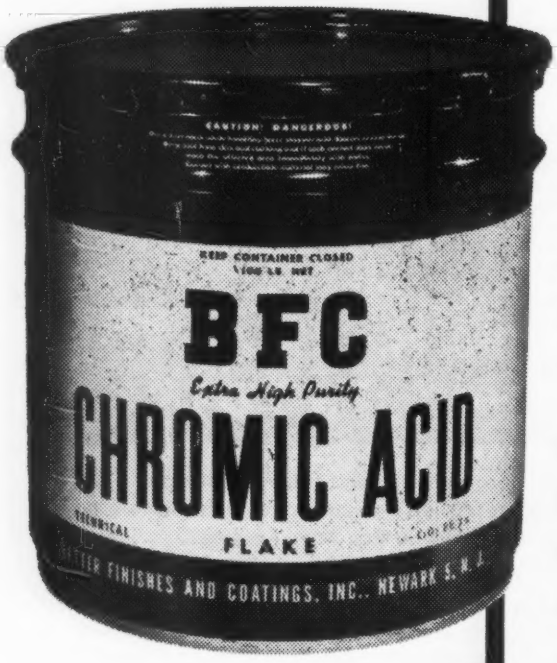
WANT TO KNOW MORE? We'll gladly treat samples or send you complete data. Write direct or call in your Iridite Field Engineer. He's listed under "Plating Supplies" in your classified telephone book.

ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD

Iridite is approved under government specifications

Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals, ARP Plating Chemicals

looks good- is good



First thing you notice about BFC Chromic Acid is its shiny cherry-red color as it comes off the flaker. It looks good and it is good. Its chemical analysis is as fine as its physical appearance.

Our plant is modern; beautifully equipped; operated by men who are real proud of the product they make. Your orders will get personal attention of owner-managers who value your business. When you are in the market, why not call us?

BETTER FINISHES & COATINGS, INC.

268 Doremus Avenue, Newark 5, N. J.

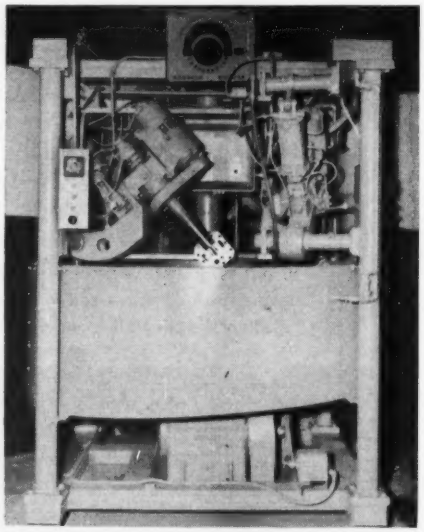
122 East 7th St., Los Angeles 14, Calif.

small scale production they are powered by electronic generators. Large arrays of cells are driven by motor-alternator equipment which can be furnished with any required power output. As an example, a 5 kilowatt motor-alternator furnishes power for an installation in a pickling or plating tank of 10 square feet of side or bottom area. Larger and smaller units are offered to satisfy almost any production requirement.

Mechanical Finishing Machine

Mecha-Finish Corp., Dept. MF, P.O. Box 308, Sturgis, Mich.

Using a controlled flow of a wet slurry at high speed, with the parts to be polished rotating in the abrasive slurry on fixtures, this new machine is claimed to improve finishes on most materials automatically.



The part to be processed is held in the abrasive by a spindle which can be adjusted to favor the area or surface to be worked on. After the spindle emerges from the abrasive mass, the holding fixture automatically opens for removal of the part while being washed and flushed and insertion of the next part.

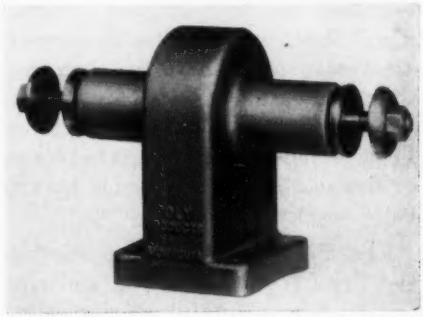
A skilled operator is not required, since the only work required is to load and unload. The unit itself is furnished with any given number of spindles from four to fourteen to meet varying production requirements.

Instead of abrasive slurry, the machine can employ steel burnishing shapes to improve the luster on parts which have been previously polished.

Bench Grinder for Light Grinding

Poly Products Co., Dept. MF, 230 East Pomona Ave., Monrovia, Cal.

The "Stubby" is a smaller copy of the larger, heavier multi-purpose grinders manufactured by the above



company. Known as Model D4, the machine is particularly useful where slower or faster than normal motor speeds are required. Housing is cast aluminum alloy with a blue hammertone finish (shipping weight 5 lbs.). Shaft is precision-ground steel and perfectly balanced on ball bearings.

Sealed bearings are permanently lubricated and pressed-on pulley is 2-step. Housing is open in back and base for either rear or undertable drive. Spindle size is ½" dia. x 11⅛" long. Thread is ½-20NF. Wheel capacity is 6". The unit is a serviceable little grinder at a very attractive price. Polishing, buffing, sanding, brushing and finishing wheels of all types may be used, as well as those for removing metal. Catalog giving full specifications will be mailed on request.

Copper-like Porcelain Finish

Pemco Corp., Dept. MF, Baltimore 24, Md.

A new finish for steel products that

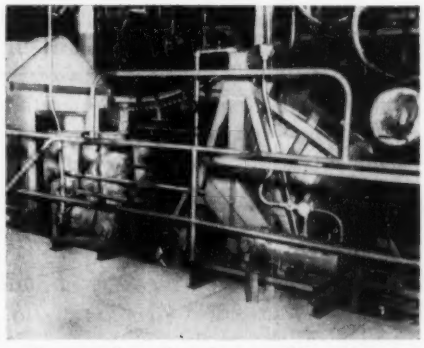
has the beauty and warmth of copper plus the durability of porcelain enamel has been developed by the above makers of porcelain enamel frit. Called "Coppertan," the finish was perfected in cooperation with Samuel Stamping & Enameling Co. of Chattanooga, Tenn., which is using the finish on its built-in kitchen ranges and upright gas ranges.

Other products for which the new finish is designed include: appliances for the home, air conditioners, cooking utensils, commercial refrigeration equipment, garbage disposals, dishwashers, gas space heaters, gas stoves, electric ranges, heating equipment, metal kitchen cabinets, portable grills, soda fountains, sinks and others.

The coating can be made in either a gloss or satin finish by a simple change in mill formula.

Washing Machine for Drums

Industrial Washing Machine Corp., Dept. MF, Matawan, N. J.



A complex cleaning problem involving the washing of steel drums has been solved by a new washing machine.

The drums are carried through the machine on a bar conveyor, while the covers pass through at the same time hanging from an overhead monorail which operates independently. The drums are automatically turned upside down for more efficient cleaning as they enter and are automatically righted as they emerge. Powerful sprays are located on the sides, top, and bottom of the machine to insure a thorough cleaning job.

BUSINESS ITEMS

Oakite Establishes New Export Division

Oakite Products, Inc., manufacturers of specialized industrial cleaning and related materials, have announced the formation of an Export Division to handle the increasing demand from Latin American and overseas companies. *Harry V. Kerker*, with the company since 1943, has been appointed manager of the new division.

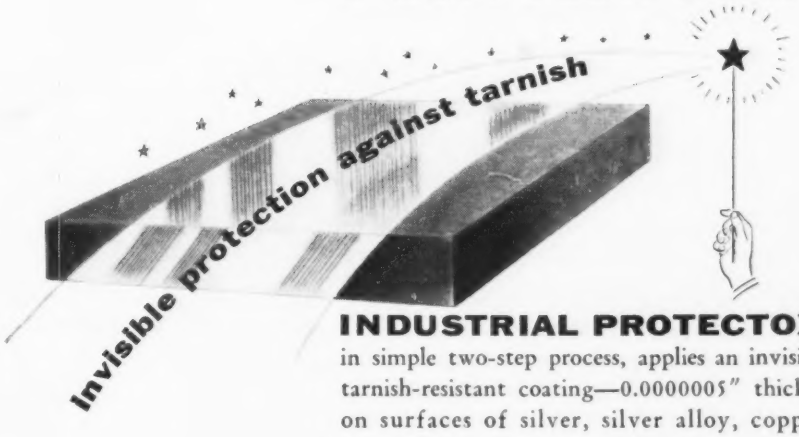
Harry V. Kerker

Carborundum Co. Appoints Darcy

Arthur E. Darcy, abrasive belt machine specialist, has been appointed manager of the machine methods department of the Coated Abrasives Division of *The Carborundum Company*, according to an announcement by *W. H. Wendel*, vice-president of the company.

As manager of the department, Mr. Darcy will expedite dissemination of information to company salesmen rela-

Technic INDUSTRIAL PROTECTOX



INDUSTRIAL PROTECTOX, in simple two-step process, applies an invisible tarnish-resistant coating—0.0000005" thick—on surfaces of silver, silver alloy, copper, brass, gold.

★ **Anti-tarnish for work in open trays, storage, shipment**

★ **Resistance to sulphur fumes, other industrial atmospheres**

★ **Excellent lacquer base, improves adherence 300%**

★ **Film easily removed without pre-treatment when desired**

Protectox treated surfaces are easily soldered—treated contacts may be built into relays and other equipment without pre-treatment or after treatment. Send for "Industrial Protectox" Data Sheet—full details, application procedures, cost, etc.

TECHNIC INC.
Providence 1, Rhode Island, U. S. A.
JAckson 1-4200
THE LARGEST ENTERPRISE OF ITS KIND IN THE WORLD

USE THIS COUPON

TECHNIC INC., 39 Snow St., Providence, R. I.

Please send "Industrial Protectox" Data Sheet.

Name and Title .....

Company .....

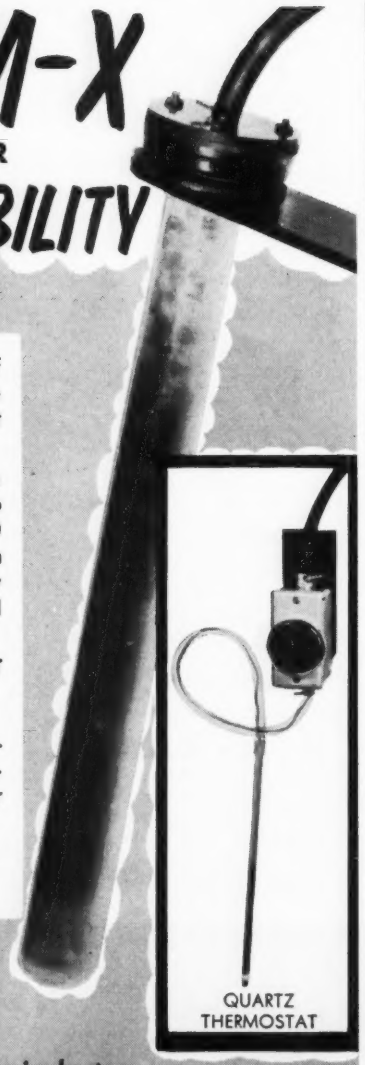
Address .....

.....

new THERM-X

QUARTZ IMMERSION HEATER

FOR RUGGED DEPENDABILITY



Here is an immersion heater with all of the plus features. Constructed with a pure fused quartz shell, it is chemically inert from practically all solvents.

The "THERM-X" heater is available in lengths from 10" to 72", from 100 to 10,000 watts and 115, 230 and 440 volts. Heater supports and protection tubes are also available. Put these newly developed heaters to work for you and be SURE you are using the finest.

"SNAP-ACTION" QUARTZ THERMOSTAT
For Control of Corrosive
Liquids and Gases

An outstanding development in heat control. Immune to chemical attack but extremely sensitive to temperature. Finger tip control by adjusting simple dial.

RATING: 22 Amperes at 120-240 volts.
Capillary tubing length 36"

Send today for descriptive literature.

Manufacturers of a complete line of immersion heaters.

N.J. THERMEX COMPANY, INC.
535 BERGEN STREET, HARRISON, N. J.

Arthur E. Darcy

tive to the various types of abrasive belt machines and advise them concerning machine recommendations to customers. He will also collaborate with abrasive belt machine builders and offer recommendations for adaptations of their abrasive belt machines to the needs of industry.

Mr. Darcy, a native of Nyack, N. Y., received his early education there, and received his B. S. Degree from Oswego State Teachers College.

After three years industrial arts teaching at Bridgehampton, Long Island, N. Y. and 3½ years as an instructor on mechanical units in the U. S. Army, Mr. Darcy became a field engineer for Porter-Cable Machine Co., specializing in abrasive belt grinders. For the past three years, prior to coming to Carborundum, he was a sales engineer for Beals, McCarthy & Rogers in Buffalo, New York where he helped to develop the machine department handling various abrasive problems.

Mr. Darcy and his family reside in Tonawanda, N. Y.

New Consulting Firm

D. R. Robson Associates, Inc. of Cheltenham, Pa. has been formed for the purpose of providing a consulting service to the electroplating and metal finishing industries. The group will provide information of design, engineering details for installation, maintenance and operation for metal finishing departments. Its field of operation will include all types of electroplating, as well as electropolishing, anodizing, chemical treatment of metal surfaces and mechanical surface improvement for appearance, corrosion protection for specific physical or chemical purposes.

The scope of the service which will be provided will include besides surveys, consultation for all phases of installation and operation, preparation of drawings and specifications, supervision for installation and, if required, complete services for a "turn-key" installation.

Casalbi Purchases Globe

Announcement was made by *Clifford M. Sparks*, president of *Casalbi Co.*, Jackson, Mich., of the purchase of the nationally known Globe tumbling barrel from the *Hupp Corporation* of Cleveland, Ohio.

Elmer A. Lord Promoted by Cowles

Elmer A. Lord, one-time Navy and collegiate boxing champion, has taken

Elmer A. Lord

over the sale of metal cleaners in Northern Ohio, Western Pennsylvania and West Virginia for *Cowles Chemical Co.*, Cleveland, Ohio.

A seven-year man with the firm, Lord has worked in production control and served as advertising and sales promotion manager before going on the road. Most recently he has represented the heavy chemical department in approximately the same area he is now covering for the metal cleaner department.

Lord served in the Navy during World War II. Assigned to St. Mary's Pre-Flight School in California, he became middleweight and light heavyweight boxing champion of the base. Later at Western Reserve University in Cleveland, he was 1946-47 Reserve boxing champion.

Lord, his wife Nancy and two daughters, Dana, 3, and Robin, 2, live at 301 East 323rd St., Wickliffe, Ohio.

Detrex Appoints Dr. Kircher

Dr. W. L. McCracken, director of research and development for the *Detrex Corporation* of Detroit, announces the appointment of *Dr. C. E. Kircher* as manager of research.

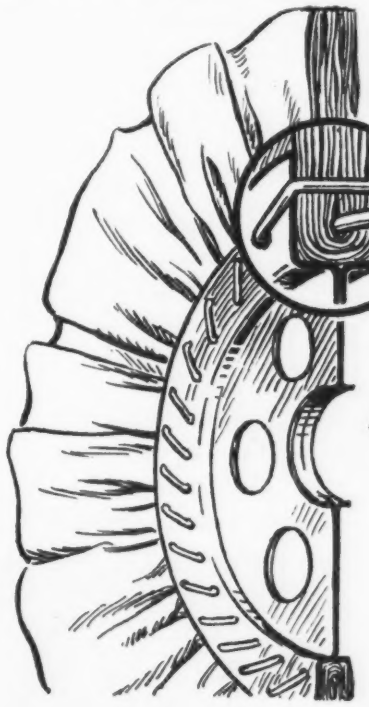
Dr. Kircher has been a member of the research staff since October of 1952, and previous to that, was associated with DuPont in Delaware and Hanford, Wash.

Dr. Kircher received his Ph.D. degree in Chemical Engineering from Iowa State College in 1942 and was professor and chairman of the Department of Chemical Engineering of Rose Polytechnic Institution for five years.

Dr. C. E. Kircher

BARKERMATIC

METAL CENTER BIAS TYPE BUFF



HIGH TENSILE STEEL STAPLE

WELDED STEEL RETAINING RING

STEEL PLATE ON EACH SIDE

STRONGER BY ACTUAL TEST

Yes, up to twice as strong!

Actual tests by an independent testing laboratory proved that the Barkermatic held together under almost double the load required to pull other buffs apart.

Barkermatics in production buffing are doing jobs with safety where other buffs have ripped loose from the center.

WHY ARE BARKERMATICS STRONGER?

The Barkermatic does not rely on small teeth part way through the cloth. In the Barkermatic the cloth is secured to the center by a solid fastening that goes completely through steel plates on both sides of the cloth. This type fastening cannot bend out and release the cloth while running at high speeds. Extra protection is provided by a steel retaining ring in the center assembly. The Barkermatic *cannot* fly apart.

AVAILABLE IN ALL SPECIFICATIONS

WRITE FOR OUR COMPLETE CATALOG.

PROMPT SHIPMENT ON MAIL ORDERS.

For added safety "USE BARKERMATICS"

BARKER BROTHERS INC.

ESTABLISHED 1911

1660 Summerfield Street Brooklyn 27, N. Y.

New Engelberg Huller Appointments

David H. Turner has been named as agent for the *Engelberg Huller Co.* in the west central territory. In making this announcement, *John T. Schenck*, president, stated that the abrasive belt manufacturing company of Syracuse, N. Y., is now being represented by a nationwide marketing force. Headquarters for Mr. Turner's activities will be 3418 Terrace St., Kansas City, Mo.

Mr. Turner has had wide experience in the field of industrial sales. In the past 23 years he has represented the S. D. Callaway Co., Gates Rubber Co., Turner Uni-Drive Co., David H.

David H. Turner

Charles M. Murphy, Jr.

Turner Associates, and the Porter Cable Machine Co. whose abrasive machine division was acquired by Engelberg Huller in 1953.

Mr. Turner's new territory will include Nebraska, Missouri, Kansas, western Iowa, and southern Illinois. He is a member of the board of directors of the J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kansas.

Charles M. Murphy, Jr., has been named sales engineer in the northeastern territory.

Mr. Murphy will make his headquarters at the company's main office, 831 West Fayette St., Syracuse. His territory will include Rhode Island, Massachusetts, Connecticut, Maine, New Hampshire, Vermont and New York State excluding metropolitan New York City.

Mr. Murphy has had wide experience in industrial sales work having held the position of sales manager for two Syracuse firms, the Morse Mfg. Co. and the Benedict Mfg. Co. He is a World War II Infantry veteran. Mr. Murphy attended Syracuse University.

Metal & Thermit Corp. to Erect New Office Building

Metal & Thermit Corp. has announced that it will erect a new general office building at Woodbridge, N. J., adjacent to the company's research laboratory. The firm, which produces metals, industrial chemicals, welding equipment and supplies, now occupies offices at 100 East 42nd St., New York City. The company's executive offices will remain in New York City.

The dual move results from expansion of activities and personnel, according to *H. E. Martin*, president, and is designed to provide more efficient office facilities and to allow for future expansion of office needs.

The new building at Woodbridge, which is expected to be ready for occupancy by April, 1956, will house the operating departments of the parent company and its subsidiary and affiliated companies in the New York metropolitan area, including sales headquarters for the northeastern region.

Executive offices in New York will continue to provide quarters for senior officers, production executives, division sales managers and the New York District sales staff, as well as certain advisory personnel.

Merrill Heads Sales in Behr-Manning Division

Henry R. Merrill has been appointed general sales manager of the *Behr-Manning Division* of *Norton Company*. Mr. Merrill, a director of the Division and its assistant general sales manager for the past two years, succeeds the late *John M. Cook*.

Henry R. Merrill

He joined the customer service department in 1930, and has been employed since 1934 in field selling operations for the Troy, N. Y. manufacturer of coated abrasives and pressure-sensitive tapes. He was made manager of the Cleveland division in 1937, became assistant industrial trades manager in 1941 and was promoted to industrial trades manager the following year.

He was elected to the directorate last year. He has served on the operating board since 1951, and as a director of the Norton Pike Co. since 1946.

Carl F. Freedman Named Executive Vice-President of American Agile

Carl F. Freedman, formerly vice-president and general manager of the *American Agile Corp.*, 5461 Dunham Road, Maple Heights, Ohio, has been elevated to the post of executive vice-president, according to an announcement by *Dr. J. A. Neumann*, company president.

The company is a major producer of plastic materials, fabrications, semi-finished components, laboratory ware, and other corrosion-resistant products, for the chemical and food processing industries.

In his new post, Freedman will direct the firm's new program of plant and product expansion. He will likewise continue to direct all commercial aspects of the company's business.

Freedman has been with the company since its inception in 1932. Prior to that, he was associated with the Boom Boiler & Welding Co., Cleveland. He lives at 4242 West 62nd Street, Cleveland.

Ogut Joins Rapid Electric

Rapid Electric Co. announces the appointment of *Mufit Ogut* to its engineering staff. Mr. Ogut came to the U.S.A. in 1946 after extensive schooling in Turkey at Tulas American School and Robert College. He resumed his engineering studies in this country and was graduated from Indiana Technical College with a B.S.E.E. degree. Graduate work was undertaken at Columbia University and at Newark College of Engineering.

Mr. Ogut's background as develop-

Mufit Ogut

ment and test engineer at Wallace & Tiernan in New Jersey brings to Rapid Electric a wealth of experience which fits in well with the company's program of expansion in the germanium rectifier field.

Graver Appoints New Representative

H. R. Fosnot, sales manager of *Graver Water Conditioning Co.*, has announced the appointment of a new sales representative. The *Atlas-Misrock Co.*, located at 110 North 8th St., Richmond, Va. will handle Graver's complete line of industrial, municipal and industrial waste treatment equipment. Their territory will include the states of Virginia, Maryland and the southern part of Delaware.

A. Misrock will be the engineering representative handling the company's equipment. He has many years of extensive experience in the water and liquid treatment fields.

Burford Moves to Pittsburgh

District Sales Manager *Robert M. Burford* of the *Pennsylvania Salt Mfg. Co.* has transferred his headquarters from Buffalo to Pittsburgh. Representing the company's metal processing chemicals department, he is responsible for the supervision of sales and service activities in its Western Pennsylvania-Eastern Ohio-New York territory. His new address is 228 Lebanon Ave., Pittsburgh.

Mr. Burford was graduated from Pittsburgh University in 1944 where he majored in chemical engineering. Before joining Pennsalt in 1947, he was employed by the Corning Glass Company.

Holzem Appointed by W. D. Forbes Co.

The *W. D. Forbes Co.* recently announced the appointment of *E. C. (Gene) Holzem* as sales manager.

Mr. Holzem is very well known in the Minneapolis area, and has been in charge of plating and polishing operations in many of the larger plants in this and other territories, as well as chief of plating operations for the Navy at Pearl Harbor during the war.

Having over twenty-five years of practical experience, as well as being well versed in all fields of plating chemistry, Mr. Holzem will be available for assistance to the trade on any finishing problems.

• Well known from coast to coast, Unichrome Coating 218X is identified by the flexible, thick, pore-free and chemical resistant protection it puts on racks in one coat . . . protection that has minimized rack maintenance costs for its users.

This green plastisol compound cures into a tough coating that doesn't chip, crack, lift at contacts, blister . . . that won't contaminate sensitive baths, that withstands all plating and cleaning solutions, even vapor degreasing cycles. Its premium quality is undisputed, its adhesion outstanding.

Remember . . . as a company that has developed plating processes, given service on plating problems, pioneered in plastisol coatings, United Chromium can deliver exactly what a rack coating needs for maximum service in your plant.

UNICHROME Trade Mark

materials · processes · equipment

for better plating at less cost

UNITED CHROMIUM DIVISION
METAL & THERMIT CORPORATION

100 East 42nd Street, New York 17, N. Y.
Detroit 20, Mich. • Waterbury 20, Conn.
Chicago 4, Ill. • Los Angeles 13, Calif.
In Canada: United Chromium Limited, Toronto 1, Ont.

Free Course in Electroplating

The Fall term in Electroplating at the Brooklyn Evening Technical High School, 29 Fort Greene Place, Brooklyn, N. Y., begins September 14, 1955. Laboratory experiments include analyses of copper, nickel, chromium, silver baths; hardness test, chemical tests for thickness; Hull cell study and anodizing. Classroom discussion covers such topics as tank area calculation, review of chemistry, wetting agents, pH, brighteners, pitting, buffer agents, throwing power, specific gravity, Baume readings, dummying, deionizing, filtration, reading graphs.

Registration begins September 12, 1955 and daily thereafter from 7:00 to 9:00 P.M. Classes will be held on Monday and Wednesday from 6:45 to 8:15 P.M. plus about six Friday nights during the term. The term begins September 14, 1955 and ends January 31, 1956. See *Mr. L. Serota*, Room BW17 or 3E10.

Promat Appoints Kahler and Ellis

The appointments of *Harold A. Kahler* as assistant to the vice-president and *Walter B. Ellis* as Western district manager have been announced by *Promat Division, Poor & Co.* Waukegan, Ill., manufacturers of metal finishing processes.

Walter B. Ellis

Mr. Kahler came to the home office after serving as eastern representative since 1953. Prior to this association, Mr. Kahler held positions in the metallurgical and chemical departments of Kaiser-Frazer Corp., and Ford Motor Co. in Detroit. He is a member of the American Electroplaters' Society, American Society for Testing Materials and American Society of Metals, and is active as a member of several committees in the societies. Mr. Kahler and his family are making their home at 1005 Rogers Court, Waukegan, Ill. Mr. Ellis becomes manager of the west coast division with offices in Gardena, Cal. His previous associations include: Plant manager of the Illinois Plating Co., Peoria, Ill.; Finishing superintendent of Dura Chrome Corp., St. Louis, Mo., and southwestern district representative for Lasalco, Inc., St. Louis, Mo. He is a St. Louis University alumnus and will make his home in Torrance, Cal.

Metal & Thermit Makes Two Appointments

H. D. McLeese has been appointed general sales manager of *Metal & Thermit Corp.*, *H. E. Martin*, president, has announced. Mr. McLeese, who had been vice-president and general sales manager of *United Chromium Inc.*, a Metal & Thermit subsidiary, will direct the sales of both companies' products.

A chemical engineer, Mr. McLeese has done research work on chromium plating with *Dr. Colin G. Fink* at Columbia University. He was formerly

H. D. McLeese

connected with Bell Laboratories and Dow Chemical Co. as a chemist and with the Chemical Treatment Co. and Chromium Corp. of America, also a subsidiary of Metal & Thermit Corp., in sales capacities.

Dr. J. E. Stareck has also been appointed director of research. In his new post he will also continue to direct the research activities of United Chromium, Inc.

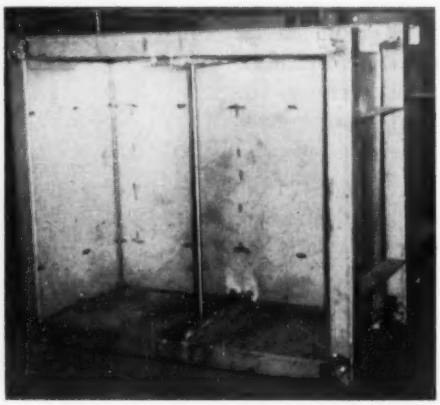
★ BUFFING NU SPRA GLU
Liquid buffing compound
since 1945

★ NUGLU
Cold flexible glue
since 1937

★ BRUSHING NUGLU
Grain and Nuglu mixture
since 1941

★ SPRAY BUFFING EQUIPMENT
Guns, pumps, and valves
since 1945

J. J. Siefen CO.
5643 LAUDERDALE · DETROIT 9, MICH.



Long Life Tank Values

STORTSWELDING gives your heavy duty tanks the reserve strength and stamina they need for standing up to high production schedules. The use of better materials and expert weldmanship is cheap insurance against early failures, high maintenance costs and expensive shut-downs.

STORTS WELDING COMPANY INCORPORATED
38 Stone Street
MERIDEN, CONN.
Manufacturers of Welded Fabrications to Specification

Dr. J. E. Stareck

Dr. Stareck joined the research staff of United Chromium, Inc., in 1935 and for a number of years was associated with its Waterbury, Conn., laboratories. In 1941 he moved to the Detroit research laboratories as director of research.

Jesse Stareck was born in Petersburg, Mich., on March 17, 1905. He was graduated from the University of Kansas in 1927 and later from its Graduate School, receiving his M.A. in 1930 and his Ph.D. in Chemistry in 1934. Prior to his connection with United Chromium, Inc., he was affiliated with the Kansas City Testing Laboratories and the Bar Rusto Plating Corp. of Kansas City, Mo.

Dr. Stareck is an active member of many technical societies. He is a member of the Detroit Branch of the American Electroplaters' Society and has preesnted technical papers at the Society's conventions and many local branch and regional meetings. In the American Society for Testing Materials he is a member of Committee B-8.

He is also active in the American Chemical Society, The Electrochemical Society, the Institute of Metal Finishing and the Engineering Society of Detroit.

New Company Formed in Canada

Recently announced was the formation and opening of *Dalic Metachemical Ltd.*, a Canadian company associated with Laboratoires Dalic, Paris, France, and Metachemical Processes Ltd., London and Birmingham, Eng. *L. W. Piddington*, formerly with Metachemical Processes, has been appointed general manager in charge of all

L. W. Piddington

operations. Offices and laboratory are located at 121 Leicester Ave., Toronto 18, Ontario, Can. The company has been established for the development and distribution of the Dalic brush electroplating process and will service both Canadian and American industries.

New Sarco Sales Agents

On April 15th, *H. L. Simmons*,

A barrel load of bright nickel with a nickel's worth of

NICKELITE

CORROSION RESISTANCE UP 30% TO 100%

With Nickelite you can get 13 to 22 hours of salt spray exposure with 0.00006 inch of barrel nickel, instead of 11 to 13 hours. Actual salt spray tests show even greater improvement with thicker deposits. And you're saving money, too!

Platers Research CORPORATION

Concentrated to quadruple strength — you don't ship, store or handle water! Shipping weight cut 275% — no deposits, no carboy returns. Stable, efficient, easily stored, easily used — a capful of Nickelite is enough for a barrel load of nickel.

59 E. 4TH ST. • NEW YORK 3

all your finishing needs

UNDER ONE ROOF

J. Holland & Sons offers you the most comprehensive operation in the entire finishing industry. Because we maintain one of the world's largest in-stock supplies of polishing, plating and spray equipment; we can deliver *in-stock merchandise immediately upon your request.*

You can forget about the problems of buying your requirements from numerous sources. Get dependability, complete satisfaction and "one-stop" buying from under our large roof!

Our engineering and technical staff is ready to assist you in solving special problems. We'll be glad to help!

J. HOLLAND & SONS, INC.

leaders in finishing equipment for over half a century

475 KEAP ST. (corner Union Ave.) BROOKLYN 11, N. Y.

president of *Sarco Co., Inc.* announced the appointment as sales representatives of *J. B. Lammons Co.*, 1596 Madison Ave., Memphis, Tenn. and *Robert Porter*, 224 N. Congress St., Jackson 2, Miss.

MacDermid Wins Infringement Suit

In March 1954, *MacDermid Inc.*, filed a suit against *Time Chemical, Inc.* in the United States District Court for the Northern District of Illinois, Eastern Division, at Chicago. In the complaint, it was alleged, among other things, that Time Chemical was using or employing the name "Anodex," and selling, distributing or exposing for sale a cleaning compound under this name.

After a hearing before the United States District Court, the Court entered a preliminary injunction and referred the matter to a Master in Chancery to ascertain whether damages should be assessed against the defendant for its infringement and whether or not the injunction should be made permanent.

After extensive hearings, the Master found in favor of the plaintiff that the injunction should be made permanent and assessed against the defendant costs of the hearings and the Court retained jurisdiction over the issues involved for any further action in the matter to provide opportunity for the plaintiff to make additional parties as defendants upon the discovery of any further evidence involving any other parties connected with a possible infringement of the copyrighted product.

ODM Releases More Copper

The *Office of Defense Mobilization* announced on May 12 that copper being acquired by the Government under the Defense Production Act and Stock Piling Act will continue to be made available to industry in the third quarter of 1955 in order to relieve copper shortages.

The action taken by ODM authorizes the General Services Administration to release the copper to hardship cases as certified by the U. S. Department of Commerce. About 16,000 tons of copper may be distributed under the order.

Federated Metals Offers High Quality Nickel Salts

Federated Metals Division, American Smelting and Refining Co., is now offering for the first time superior quality nickel salts for nickel plating. These salts complement the full line of plating anodes that the company currently furnishes. The crude salts are a by-product of electrolytic copper refining. As a result of better crude and consistent quality control during manufacture, the salts are claimed to contain full nickel content. The nickel salts are available in 100 pound laminated paper bags through leading metal plating supply distributors.

Delpark to Sell Olson Pressure Type Filters

In a combined announcement, *George L. Guymon*, vice-president of *Industrial Filtration Co.*, distributors of Delpark industrial filters and *R. E. Mitchell*, vice-president, *Olson Filtration Engineers, Inc.*, Chicago, announce the signing of an exclusive franchise authorizing Delpark to handle sales for the Olson pressure

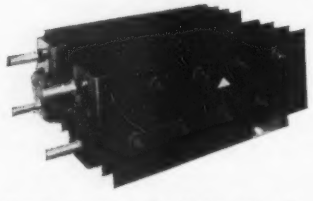
BUY Lektron® RECTIFIER

For the Finest in PLATING RECTIFIERS

A BETTER SOURCE OF DC POWER — MORE FOR YOUR MONEY

★ Operate from —40° to 225° F.
★ 50 to 50,000 Amperes DC
★ Built-in Voltage Regulator and Meters
★ Heavy Duty Transformers, Husky Fans

Two styles available—1. Selenium for cool zones, or 2. Magnesium copper sulphide for the hot, dirty jobs. Units still running after 4 years of constant duty.



Replacement Rectifier Stacks for Lektron or Udylite-Mallory

Magnesium copper sulphide rectifiers make your plating power supply more rugged and dependable. Magnesium radiator fins for fast heat dissipation and lighter weight. Matching pairs.

Model 4045—750 amps at 12 volts DC—1500 amps. at 6 volts DC. Operates on 208, 220 or 440 A.C. Weight 525 lbs. F.O.B. Indianapolis, Indiana.

SOME JOBBERS AND SALES TERRITORIES OPEN

ELECTRONIC RECTIFIERS, INC.
2102 SPANN AVENUE INDIANAPOLIS 3, INDIANA

FASTER, BETTER FINISHING WITH HARRISON'S NEW

4A

BUFFING AND POLISHING COMPOUNDS

You send us sample of metal used. We will return finished sample together with compound for your specific requirements. Speed up productions with correct compositions.

HARRISON & COMPANY, INC.
HAVERHILL, MASSACHUSETTS

type filters in the metalworking and industrial fields.

The announcement, effective immediately, makes available through Delpark representatives the original tubular element type filter using diatomaceous earth. The Olson filters, covered by United States Patent 2,693,282, uses the precoat principle by coating screen type tubular elements with diatomaceous earth. The liquid passes through the earth into the tubular screen and is pumped back into the system.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

Waterbury Branch

The April 14th meeting was held in the Colonial Room of the Hotel Elton. President *Perry Sloane* gave a run-down of the branch accomplishments during his term of office. He expressed the hope that the combination business meeting and technical session that was started this year be continued.

Frank Eddy installed the officers for the coming year, 1955-1956. The new officers are:

President — *Joseph Petrocelli.*

1st Vice-President — *George Dubpernell.*

2nd Vice-President — *Theodore Voyda.*

Secretary-Treasurer — *Spencer L. Henn.*

Assistant Secretary — *Albert Griffith.*

Librarian — *Edward J. Garland.*

Assistant Librarian — *William P. Innes.*

Publicity Director — *Frank Tirendi.*

Board of Managers — *Perry Sloane, Frank Eddy, Edward V. Collins.*

At the conclusion of installation, the meeting was turned over to the new president, Joseph Petrocelli who commented on the remarks made by Past President Sloane as to keeping the business and technical meetings intact. He felt that such a combination would allow greater expression by the membership.

Toastmaster *Bill Starr* presented pins to the past presidents of the branch. This proved very interesting as each past president had something to say about what he remembered most during his term of office.

Ellsworth Candee reported on new sustaining members. They are:

American Electro Products, Inc.
Eastern Electroplating Co., Inc.
American Brass Company
Summit Finishing Company
Crane Equipment & Supply Co., Inc.
Harper Leader, Inc.
Whyco Chromium Co., Inc.

F. Tirendi,
Publicity Director

Central Michigan Branch

The May meeting of the Central Michigan Branch was held at the Meadowlark Inn in Jackson, Michigan on the evening of May 10, 1955. This was a dinner meeting sponsored by the Udylite Corp. of Detroit.

The speaker for the evening, *Richard Scott*, electrical engineer for Udylite took as his subject the use of germanium rectifiers in the plating process. He pointed out that the germanium rectifier is one of the newest developments in D.C. power supply for plating operations. Mr. Scott also pointed out that these rectifiers are smaller than other type rectifiers for

BEAM-KNODEL CO.

Metropolitan Distributors

HANSON-VAN WINKLE-MUNNING CO.

Complete Service for Metal Finishing

Products Listed Below Available in New York Stock With Reasonable Exceptions

GENERATORS

Anodes, All Kinds	Tallow	Nickel Salts
Brushes	Rouge	Copper Salts
Buffs	Emery Paste	Cyanide
Chemicals	Cleaners	Tanks, All Kinds
Tripoli Comp.	Emery	Plating Barrels
Acme White Finish	Glue	Polishing Wheels
		Polishing Lathes

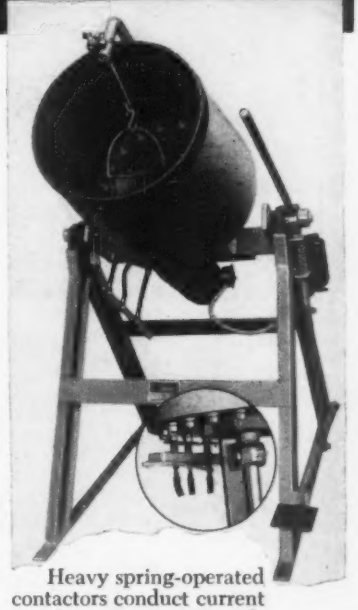
195 LAFAYETTE ST., COR. BROOME
Phone CAnal 6-3956-7 NEW YORK 12, N. Y.

FILTERS

MAIZO Drying Materials

LEA Buffing & Polishing PRODUCTS

Large Oblique Plater
for quantity production of small, hard-to-hold articles



No perforations—plates, needles, springs and small wire parts that catch in or slip through perforations in horizontal plating barrels.

Large barrel, 23" dia. by 23" deep; capacity, about 2 pecks. Made of heavy sheet steel lined with ¼" thick vulcanized rubber.

Tilting lever and foot-operated lock simplify loading, unloading and removal of solution.

Chrome plated button contacts bring current through bottom. Only contacts in the work carry current.

Anode basket to use scrap anodes. Saves time—avoids waste.

Send for literature or ask BELKE Service Engineer.

Heavy spring-operated contactors conduct current only to contacts in work.

Belke MFG. CO., 947 N. Cicero Ave., Chicago 51, Ill.
EVERYTHING FOR PLATING PLANTS

comparable output and they are also more efficient.

A film "Fishing in Michigan" was shown through the courtesy of the Michigan Conservation Dept.

R. W. Boos,
Publicity

Buffalo Branch

At the May meeting of Buffalo Branch *Dr. C. J. Wernlund* of E. I. DuPont de Nemours & Co., Electrochemicals Department, gave a very interesting discussion on "A New Versatile Improvement in Cyanide Copper Plating." His discussion was well received. After a lengthy question and answer period he was given a vote of thanks by the branch.

One application for membership was received and referred to the board of managers. There were two visitors, *Allen Feder* of Bell Aircraft Corp., and *Frank Baldwin* of S.A. Day Mfg. Co.

Joseph Ruff reported that all preparations have been made for the picnic July 30 at the Kendall Club on Chautauqua Lake, N. Y.

Eric C. Sampson, Jr.,
Secretary

Chicago Branch

With the summer now in full dress and vacation schedules beginning to contribute to absenteeism, a surprising number of the members of Chicago Branch turned out to listen to the guest speaker of the May 27 meeting. *William Radtke* of Smoothex, Inc., discussed the subject of "Bright Copper Plating" with a view to its applications. His presentation, nicely complemented by the showing of a number of 35mm. slides, was well received. Though most members have had considerable experience with bright deposits of one sort or another, only a few have had experience in producing truly bright copper. As a result there was an active question period following the talk.

Due to unavoidable absences, two members of the panel of experts were held over from the May to the June meeting. The June panel consisted of:

Gene Gryglas, Cinch Mfg. Co.; *Klem Petrosius,* Superior Plating Works and *Ken Goodpasture,* Admiral Corp.

The knowledge of the above experts ranged from general plating processes through the finishing of automobile hardware, and various radio and electronic components. They gave very capable responses to all questions.

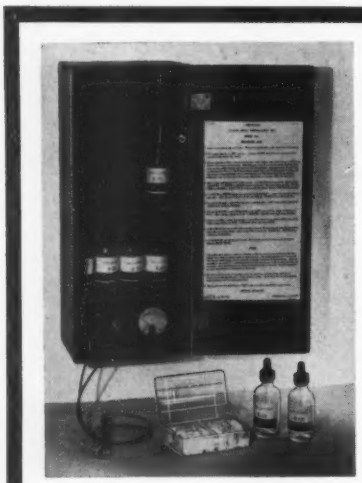
After reports from various committees, reminders of the Annual Convention to be held in Cleveland, and after all current fish stories had been put to rest, regular operations of the branch were suspended for the summer. Business meetings will be held as usual during July and August and technical sessions will be resumed in September.

Jerome Kuderna,
Publicity Chairman

Los Angeles Branch

A talk on "Chemical Films for Aluminum" by *Thomas P. Rogers,* Los Angeles representative of the American Chemical Paint Co. of Ambler, Pa., was the highlight of the education session of the May 11 meeting of Los Angeles Branch, American Electroplaters' Society.

Mr. Rogers gave a complete rundown on protective coatings for aluminum. He discussed the purposes of each deposit and the types and com-



THE KOCOUR METAL IDENTIFICATION SET MODEL PIA

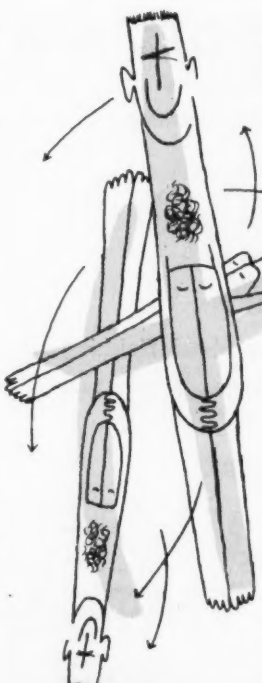
Rapid tests for the positive identification of cadmium, tin, silver, lead, nickel, chromium, zinc, absence or presence of chromate conversion films.

EASY TO USE!
Write for literature!

● KOCOUR testing sets are used all over the world for controlling plating — cleaning — pickling — anodizing — and hardening processes . . . special sets can be provided for your requirements.
Write today for complete information — no cost or obligation.

KOCOUR COMPANY
4801 S. ST. LOUIS AVENUE
CHICAGO 32, ILLINOIS

Specify KOCOUR test sets from your supplier.



WORTH SEEING!
HARTFORD'S FAMOUS
TRIPLE ACTION

IN A NEW
FULLY ENCLOSED
CUTTING BARREL

There's a new look in Hartford's Cutting Barrels . . . and many new features for doing each job better . . . faster . . . at lower cost. May we send you complete information? Your inquiry will receive our prompt attention.

Hartford

PRECISION BALLS — RETAINERS
BEARINGS — CUTTING BARRELS

Hartford Steel Ball Co., Inc., 13 Jefferson Ave., West Hartford 6, Conn

positions of various such coatings. He also covered such phases of his subject as anodic oxidation, the composition of protective oxide films on aluminum, measurements of anodic coatings, and the chemical production of crystalline phosphate coatings on the surface of aluminum.

The business session of the May 11 meeting was attended by 95 members and guests with *Earl W. Arnold* of the L. H. Butcher Co. presiding for the first time since his recent election as branch president.

Plans mapped at a special convention rally the previous week relative to ways and means of persuading the Supreme Society to award the 1960 national convention to Los Angeles were explained by President Arnold, Secretary *George Hetz*, *Earl Coffin* and various other members.

The reports revealed that Los Angeles Branch is determined to go "all out" in an effort at Cleveland to get the 1960 conclave. Upon motion of Hetz, seconded by Arnold, and unanimously approved, it was voted to appropriate a substantial sum of money to be spent at the discretion of delegates Arnold, *Truman Stoner* and *Glen Beckwith* at Cleveland. The cooperation of the Los Angeles Chamber of Commerce has also been obtained, with a promise to supply banners, badges, booklets and novelty souvenir items designed to make the AES convention at Cleveland Los Angeles conscious, when discussion of the 1960 convention site is taken up. Letters addressed to the various branches soliciting support of the Los Angeles bid will be mailed before June 1.

Second vice-president *George Magurean*, the new membership chairman, got his regime off to a good start when seven new members were initiated on May 11. These were: *George W. Slomin* of George W. Slomin Associates; *Burton G. Adams*, Pennsylvania Salt Mfg. Co.; *J. M. Routen*, Sanford Process; *William T. Wilson*, Skylark Plating Co.; *Fernando Alvarez*, Patterson Plating Co.; *Everett W. Elgin*, G&E Buff Co.; and *James R. Hodges*, Alert Supply Co.

Among visitors introduced by Sergeant-at-arms *Pete Esten* were *Lou Fleming*, L. H. Butcher Co.; *Troy Withers*, Harvey Machine Co.; *Don Wichen*, State Canvas Co.; *Paul Kokritz*, Los Angeles Parkerizing Co.; and *Robert Meyers* (Chicago Branch), formerly superintendent of finishing for the J. C. Furniture Co., Chicago, who vacationed in Los Angeles in May.

A visitor from across the Pacific was *Don Isaacs*, owner of Chrome Hardening Pty, Ltd., St. Peters, New South Wales, a suburb of Sidney, Australia. Mr. Isaacs arrived in Los Angeles early in May as the first stop on a tour of the United States and Canada preliminary to attending the AES convention in Cleveland, at which he will serve as a delegate from Sidney Branch. Mr. Isaacs has been a member of the AES since 1936. He was formerly affilliated with Hartford and Waterford, Conn., Branches, and later with Los Angeles Branch before the Australian units were set up. His itinerary called for visits to plating shops in Los Angeles, New Orleans, Washington, New York, Boston, Toronto, Montreal, Chicago, Detroit, and Cleveland. His shop in Australia, he reported, is equipped primarily to do hard chromium plating and replating

BOOKS FOR YOUR PLANT LIBRARY

PRINCIPLES OF ELECTROPLATING AND ELECTROFORMING
REVISED THIRD EDITION
$7.00 PER COPY

•

METALLIZING NON-CONDUCTORS
$2.00 PER COPY

•

DICTIONARY OF METAL FINISHING CHEMICALS
$3.00 PER COPY

•

1955 METAL FINISHING GUIDEBOOK-DIRECTORY
$3.00 PER COPY

Book Orders Payable in Advance

FINISHING PUBLICATIONS, INC.
381 Broadway Westwood, N. J.

on auto parts, diesel engine liners and hydraulic rams.

Pittsburgh Branch

The annual Ladies Night Banquet was held in April by the Pittsburgh Branch at the Churchill Valley Country Club.

Approximately 250 enjoyed an excellent prime ribs of beef dinner and a wonderful show staged by about 20 performers from the Westinghouse Electric Corp. amateur group. Proceeds from all their performances go to charity. It was the best entertainment we had seen in many a year.

Leo J. Schmitt, Sr. was presented with an honorary membership in recognition of his long service and expert counseling since the early days of the branch.

A most enjoyable evening was concluded with dancing, beverages, favors for the ladies, and valuable door prizes.

A rousingly successful banquet, one of the best in many years, the credit goes to co-chairmen *Harry Flister* and *Ken Hittle* and their committee of *Rex Goldbach, Bill Pizoli,* and *Bill Wilson.*

Pittsburgh Branch

The final meeting of the season was held in the Lafayette Room of the Sherwyn Hotel with steak as the main course. The business for the evening consisted of one new application for membership, *R. S. Vaupel,* a financial report on the Ladies Night Banquet by *W. Pizoli* that the branch broke even, election of a new board of managers consisting of *R. Goldbach, E. Washburn* and *R. Varner,* and the installation of new officers by *Leo Schmitt.*

The following prizes were given by the Electroplating Projects Dept., Westinghouse Electric Corp. through the efforts of *Myron Ceresa*:

Perfect Attendance — Pocket bookkey case combination and Zippo lighter: *Myron Ceresa, Fred Dixon, K. Hittle, Art Koupe.*

For missing only one meeting — Zippo lighter: *James Crain, Bill Musmanno, Rex Goldbach, Harry Flister, Herb Schram, Bob Varner, Henry Schaltenbrand.*

For missing only two meetings — Automatic lead pencil: *W. Bohman, Glade Bowman. Albert Hart, Loren McOmber, Eugene Momeyer, Bill Pizoli, Russell Reynolds, David Porter, Charles Churchill. F. W. Stockton E. B. Washburn. Bill Wilson.*

The speaker for the evening was *B. G. Daw* of LaSalco Inc. who talked on "What Happens in a Plating Barrel." Emphasizing how much to put in a plating barrel and explaining how to calculate this factor, he brought out the fact that most barrel plating troubles result from overloading and brought along his own movies to clinch the argument.

After a short pause for refreshments and the drawing for the door prize Mr. Daw had a ready answer for some real tough questions. The door prize, a Westinghouse table model radio presented by *Harry Flister* of Wyandotte Chemicals Corp. was won by *Herb Schram.*

Herb Schram,
Secretary

Twin City Branch

The May meeting, which was held at the Covered Wagon in Minneapolis, commemorated the past presidents of

Insure successful, economical, uninterrupted

ZINC PLATING

by purifying cyanide zinc plating solutions with

McKeon's

Zinc-Brite

TRADE MARK REG'D.

No Other Purification Treatment Required.
Simplifies Zinc Plating Procedure.
Substantially Reduces Overall Plating Costs.
WRITE - PHONE - WIRE

Sulphur Products Co. Inc.
228 McKeon Way
Greensburg, Pa.

NOW...
GREATER PERFORMANCE
WITH
"PYROSIL"
QUARTZ
ELECTRIC
IMMERSION
HEATERS
Provides accurate bath temperature control with greatest efficiency. Pyrosil quartz immersion heaters are immune to attack from all acids at any concentration or temperature, except Hydrofluoric and concentrated Phosphoric.
• NO HEAT LOSS
• EASY TO INSTALL
• ACID RESISTANT
• SOLIDLY CONSTRUCTED
• ACCURATE TEMP. CONTROL
Check your local Supply House or write:
PYROSIL Inc.
Cuyahoga Falls, Ohio

the Twin City Branch. The following is a list of the individuals who have served the branch in the office of president: *E. H. Lindeman*, 1944-45; *A. T. Leonard*, 1947-48; *Dr. F. Ireland*, 1948-49; *Clifford Bowman*, 1949-50; *Albert A. Joiner* (deceased), 1950-51; *D. Wray Schorr*, 1951-52; *Jerome M. Weller*, 1952-53; *Paul R. Hesse*, 1953-54; *George Reed*, 1954-55. *B. J. Rosentha*, who was master of ceremonies for the event, presented each past president with a beautiful blue and white anodized plaque mounted on a walnut backing.

The plaque for Mr. Joiner was accepted by his two sons. It is the plan to have samples of the plaques, which were manufactured by Hiawatha Metalcraft, on display at the National Convention. *Robert L. Buckley*, who has been secretary-treasurer of the branch since its inception was presented with a movie camera for his years of faithful service.

A social session followed the meeting as *R. J. Rahr* of the Mitchell-Bradford Chem. Co., who was to address the group on "Blackening of Metals" was unable to attend due to a death in his immediate family that day.

Louisville Branch

The regular monthly meeting of the Louisville Branch was held Thursday, April 21, 1955, at Kapfhammer's Party House, 1506 South Shelby St., Louisville, with a dinner served at 6:30 p.m. Vice-President *K. E. Reifsteck* opened the business and open meeting at 8:00 p.m., with twenty-two members and guests present.

The newly elected officers for the 1955 to 1956 fiscal year are as follows:

President — *William W. Francis.*

1st Vice-President — *Kenneth C. Reifsteck.*

2nd Vice-President — *Stanley J. Beyer.*

Sec'y & Treasurer — *Joseph G. Sterling.*

Librarian — *John S. Houston.*

Sergeant at Arms — *John Kehrer.*

Board of Managers — *Arthur A. Oertel, P. H. Pate, John W. Scholl.*

The meeting was then turned over to Librarian *Stanley J. Beyer* who introduced the speaker, *J. D. Little* of the McGean Chemical Co., Cleveland, Ohio. Mr. Little, in his talk on "Trouble Shooting in Bright Nickel Plating," described various problems encountered.

A lot of variables can cause difficulties, such as poor polishing, degreasing, cleaning, acid dips, rinsing, current, temperatures, linings, filtration, pH, and unsatisfactory chemical adjustments. The cause of the rejects must be looked into and find the source of the trouble before proper correction can be made.

Considerable discussion followed and Mr. Little was given a rising vote of thanks for a very interesting talk. The meeting adjourned at 10:30 p.m.

J. G. Sterling,
Secretary & Treasurer

Assn. of Consulting Chemists and Chemical Engineers

The Association adopted on April 26, 1955 amendments to its by-laws with more flexible qualifications for candidates. Specifically, new provisions are included in a re-classification for foreign members and affiliate members, the first term applying to members with headquarters overseas, not including U.S.A. territories, and

Tamms

NEW!

Soft amorphous type

MICRO-SILICA

with these special features

OIL ABSORPTION (G 3 0) ..... 36.4 to 40.3 LBS.
PH VALUE ..... 5.0 to 5.2
MOISTURE 5%

A NEW PROCESS SILICA

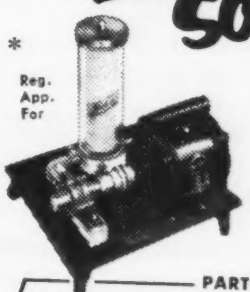
PARTICLE SIZE RANGE 1 TO 15 MICRONS
98% MINUS 10 MICRONS

New improved equipment assures highest quality and production control

WRITE TODAY FOR SAMPLES, PRICES AND SPECIFICATIONS

TAMMS INDUSTRIES, INC.,
228 N. La Salle St., Chicago 1, Ill.

Filter your solutions!



Reg. App. For

50-2400 GAL/HR.

Self-priming Model LSIN-10 . . . Cap. 100 gal/hr. H.T. Lucite Filter Assembly. Stainless pump . . . totally enclosed Motor . . . portable . . . Wt. 60 lbs. . . . 14"x16"x16" high.

Distributors in principal cities.
Write for literature.

PARTIAL LIST OF MODELS

Model	Rated Capacity	Overall Size	Weight
LSI-5	50 gal/hr	11"x14"x12"	30 lbs.
LSI-10	100 gal/hr	12"x16"x16"	40 lbs.
ASI-300	300 gal/hr	2'x2'x2'	125 lbs.
ASI-600	600 gal/hr	2'x2'x2'	150 lbs.
RLS-1200	1800 gal/hr	2'x3'x3'	300 lbs.

SERVICE . . . Filters practically any acid or alkaline solution from pH 0 to pH 14; removes particles down to one micron in size. Strainer stops metallic objects.
DESIGN . . . **Filter Assembly** fabricated of stainless steel 316, high temperature lucite, rubber-lined, Haveg or Sethrin* resin. **Filter Tubes** of cotton, dynel, porous stone or porous carbon. **Pumps** fabricated of Hastelloy, stainless 316 or plastic; centrifugal or self-priming. **Motors** drip-proof, totally enclosed, or explosion proof, 110 or 220 volt, single or three-phase, 50 or 60 cycle, sleeve or ball bearing. **Hose** — special acid and alkali resistant. **Base** — Linen Phenolic laminate on rubber tire ball bearing casters.

Sethco MANUFACTURING COMPANY
74 Willoughby Street • Brooklyn 1, New York

the second applying to consultants having but recently entered consulting practice. Copies of printed amended by-laws available in writing to the Association, 50 East 41st St., New York 17, N. Y.

News from California

By Fred A. Herr

Francis O'Dell, formerly plating foreman for Surface Alloys, Inc., Los Angeles, reports that he and three associates have organized a new plating firm named Metal Surfaces, Inc., with shop and offices in the factory building of Industrial Heat Treating Co., 3370 Benedict Way, Huntington Park, Cal.

O'Dell is president; *Gordon Gee* and *D. V. Campbell,* vice-presidents; and *Ty Colbert,* owner of Industrial Heat Treating, treasurer. Initially a 5,000 square foot area of the building is being used, O'Dell reported, but separate and larger quarters are already under consideration. The new company's facilities at present consist of equipment for electro-polishing, stop-off copper, and nitriding, mainly on aircraft parts.

Fleetline Plating Co., formerly at 2125 Amey St., Los Angeles, has moved to larger quarters at 5898 S. Central Ave., according to *Warren Davis,* owner. The move represents a substantial expansion on the part of the firm. The new facilities involve two separate buildings: A 53′ x 53′ main shop equipped for polishing and plating and a 15′ x 15′ foot building which has been equipped as a stripping room with separate power and water lines. Holdover equipment, Davis reports, has been augmented by the installation of a new rectifier, a new 700 gallon bright nickel tank, a new 450 gallon copper tank, and a new cleaner tank. The plant is set up to do polishing, copper, nickel and chrome plating, oxide finishing, and machine work.

Sanford Process Co., Inc., currently has a program of expansion under way, involving the equipping of a recently acquired factory building at 6920 S. Central Ave., Los Angeles, into what is reported by the owners to be the only plant in the world devoted exclusively to hard coating of aluminum. The firm specializes in hard coating aluminum by their own process. Renovation of the 10,000 square foot building, and equipping it, will cost an estimated $300,000, according to general manager *J. B. Franklin.* Much of this outlay is for a large refrigeration plant (a 150 ton Freon installation); a network of cooling coils under the floor to maintain the solutions at 0 to 15 deg. F.; a room with five compressors required to provide the compressed air to agitate the tanks; and other special equipment needed in the process of hard coating aircraft parts, automotive items, etc.

The company, a subsidiary of Far-

Alert
BUFFING COMPOUNDS
MADE IN CALIFORNIA
FORMULATED SPECIFICALLY TO MEET LOCAL NEEDS
•
PLATING AND POLISHING EQUIPMENT AND SUPPLIES
CLEANERS • ANODES • GENERATORS • RECTIFIERS, etc.
Alert SUPPLY COMPANY
4755 E. 49th STREET LOS ANGELES 58, CALIF.
SAN FRANCISCO — SEATTLE
Phone LOgan 8-4781

CUSTOM MADE
PLATING RACKS
Designed and Built to Specifications
ENGINEERING SERVICE
STAINLESS STEEL DIPPING
BASKETS IN STOCK
CALIFORNIA RACK COMPANY
4982 FIRESTONE BLVD., SOUTH GATE, CALIF.
Ph. LUdlow 1-8228

METABOND
MEANS PROGRESS IN RUSTPROOFING
METABOND is the only effective immersion or spray amorphous type zinc coating in the industry today.
METABOND withstands severe and consistent flexing and bending without chipping or breaking bond.
IRCO PRODUCTS CONQUER RUST THE WORLD OVER
INTERNATIONAL RUSTPROOF CORPORATION
12507 PLOVER AVENUE • • • • CLEVELAND 7, OHIO
MANUFACTURERS OF RUST PREVENTIVES AND CORROSIVE SOLVENTS

Best Co. of Los Angeles, was established in 1952 to explore the process evolved by *P. Sanford*, Los Angeles chemist, and to determine its commercial practicability. The original small 4,000 square foot plant at 35th and Main Sts., Los Angeles, is being retained as a pilot plant.

George Magurean, formerly a member of the plating division of U. S. Spring & Bumper Co., Los Angeles, has joined the staff of the process control department of the Convair Division, General Dynamics Corp., Pomona, Cal. George is second vice-president of Los Angeles Branch, A.E.S.

Robert Meyers, a well known figure in Chicago plating circles, spent a vacation in Los Angeles and vicinity recently. Mr. Meyers, a member of Chicago A.E.S. Branch, formerly served as superintendent of finishing for the J. C. Furniture Co., Chicago. He had severed his connection with that firm, due to a severe illness, and decided to spend a part of his convalescing period in California. Mr. Meyers met a half dozen or more transplanted Chicago platers when he showed up at a meeting of Los Angeles Branch.

The part technical publications play in helping his organization operate efficiently was outlined in a talk presented by General *Clinton D. Vincent*, vice-commander, Western Air Defense, before the Technical Publishing Society which held a 2-day conference at the Biltmore Hotel, Los Angeles, May 27 and 28.

Other speakers were *Dr. Howard S. McDonald*, noted educator, and *Carroll Alcott* of the Columbia Broadcasting Co.'s News Bureau.

The Technical Publishing Society is a recently formed California nonprofit organization whose membership encompasses personnel of the aircraft, electronic, chemical and commercial industries. The Society's purpose is to foster higher standards in the technical publishing field and to improve the professional competence of individuals in their chosen specialty. *A. E. Tyler* is president.

Couch & Philippi, Inc., manufacturers of baked enamel steel signs, early in July moved from 215 San Fernando Road, Los Angeles, to larger plant facilities at Stanton, Cal., 45 miles south of Los Angeles. The new plant contains 30,000 square feet of working area. Main building, with adjacent smaller structures, ground and equipment represent an investment of $125,000. Complete facilities for fabricating and finishing the signs are included.

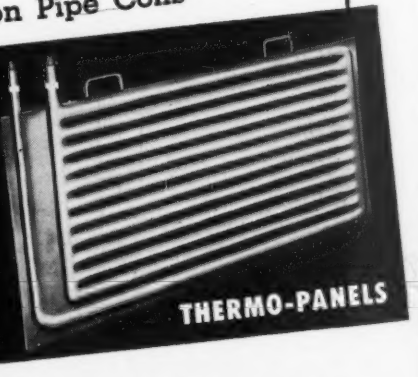
Additional facilities to complete a 4½ million dollar expansion program for the Hunter Engineering Co. at Riverside, Cal., have been announced. In the design stage are plans for a large laboratory building with supporting shops, an administration building, stock rooms and maintenance shops. The new structures will occupy 134,432 square feet. Hunter Engineering is a research and development organization geared to work in metallurgy, physics, plastics, chemistry and electronics. Work is primarily in the metallurgical field dealing with the improvement of equipment for the fabrication of nonferrous metals.

Ground was broken in June for a $13,000,000 plant to be built at Para-

HEAT EXCHANGE

An Improvement on Pipe Coils

use DEAN



• For use in the heating or cooling of solutions for plating, degreasing, metal washing, bonderizing, etc.

These engineered, scientifically designed heat exchangers provide performance that can be definitely anticipated. They are low in first cost . . . light weight . . . easily replaced . . . simple to clean. Available in special shapes such as "U's", "L's" and cylinders . . . and a wide range of materials, including iron, stainless steel, monel and other special alloys.

SEND FOR FREE BULLETIN GIVING FACTS AND PRICES

Address Dept. MF

Manufacturers Representatives Wanted

Choice territories now open. Write for details

THERMO-PANEL DIVISION

DEAN PRODUCTS, INC. • 616 Franklin Ave., Brooklyn 38, N.Y.

STerling 9-5400

mido Products

NO MAGIC . . . . NO GIMMICKS

JUST YEARS OF RESEARCH AND HARD CHEMICAL FACTS FROM OUR LABORATORIES DEVELOPED

BF #3

A dual-purpose Barrel Finishing Compound, we believe to be the most versatile on the market today.

For all metals — abrasive and burnishing — non-darkening — non-corrosive — added brightness on zinc and aluminum.

WE CARRY A COMPLETE LINE OF NORTON ALUNDUM TUMBLING ABRASIVES FOR WEST COAST USERS

Write or call for free engineering and chemical service for your barrel finishing problems.

MIDO PRODUCTS

1801 BORDER AVENUE

TORRANCE, CALIFORNIA

mount, Cal., near Los Angeles, for American Brass Co. The mill will have an annual capacity of 30,000,000 pounds in full operation.

Manufacturers' Literature

Chlorinated Solvents

Solvay Process Div., Allied Chem. & Dye Corp., Dept. MF, 61 Broadway, New York 6, N. Y.

A new 26-page booklet describes the company's line of chloromethanes —methyl chloride, methylene chloride, chloroform and carbon tetrachloride. The physical and chemical characteristics of these solvents are detailed in this booklet, together with information on shipping containers, handling and storage.

Polishing Backstand

Hammond Machinery Builders, Inc., Dept. MF, Kalamazoo, Mich.

Bulletin 345 describes the Model 524 Backstand for belt polishing. Prices are available for all types on Price List B-455.

Solution Filters

Bart-Messing Corp., Dept. MF, 229 Main St., Belleville, N. J.

A fully illustrated, four-page booklet describing the Sel-Rex Double Duty Filters for use in electroplating paints and varnishes, etc. has been prepared by the above company.

The booklet describes the new filtration principle, utilized by the filters, which provides double filtration area and volume.

Illustrated and described also are the filter element, which is secured to the tank cover and lifts out for easy cleaning, a special hand operated davit to facilitate removal of the filter element on larger units, and other special design features.

Alkaline Stripper for Rust, Paint, Phosphate Coatings

Oakite Products Inc., Dept. MF, 154C Rector St., New York 6, N. Y.

A new method of removing paint, phosphate coatings, rust, and oil from metal surfaces, a method that is said to eliminate as many as six operations, is described in a recently published folder.

The folder discusses Oakite Rustripper, a new alkaline detergent which, the manufacturers claim, simultaneously removes rust and grease from new products; rust, paint and phosphate coatings from rejects and from used products which are to be refinished. The folder tells how the stripper can eliminate such operations as pickling, vapor degreasing, and wire brushing.

Bipolar Plating Process

Yorktowne Special Products, Dept. MF, Box 293, Red Lion, Pa.

Bulletin 609 describes the new industrial Easyplater process. Presented is a summary of the operation of the process, and the advantages over the conventional and electroless methods of depositing metals.

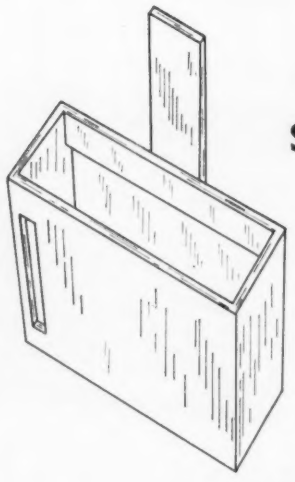
Featured is a reference chart of the 15 finishes, which include many of the newer alloys, together with information on the use, temperature, condition plated, thickness, equipment

WE ADMIT
OUR FINISH WILL NOT
B L I N D
YOU
BUT WE ARE SURE
TRUE BRITE
(BARREL)
NICKEL
BRIGHTENER
CAN
HELP YOU

- BRIGHTER — Equal to best still tank quality
- BETTER DUCTILITY — No cracking or pealing
- SIMPLE TO USE — Temperature not critical and no carbon treatments necessary
- LOWER COSTS — 8 oz./100 gals. to start and 2 to 5 oz. addition/500 amp. hours
- NO RETURNABLE CONTAINERS — In 1 gal. jugs

WRITE FOR TECHNICAL BULLETIN ON BARREL NICKEL PLATING

TRUE BRITE CHEMICAL PRODUCTS CO.
BOX 31A, OAKVILLE, CONN.
HANDLED BY LEADING DISTRIBUTORS



NOW
DUAL-RANGE
SLOT CELL

CELL ONLY
$10.00

ADVANTAGES

1. INDEPENDENT OF ANODE POSITION OR ANODE POLARIZATION.
2. CAN BE IMMERSED DIRECTLY IN BATH OR BEAKER — NO TEMPERATURE CONTROL PROBLEM.
3. UNIFORM CURRENT VERTICALLY — CONTINUOUS CHANGE HORIZONTALLY.
4. REPRODUCIBLE PLATING ON BACK OF PANEL FOR BETTER READING IN LOW CURRENT AREA.

LANCY LABORATORY
533 WAMPUM AVENUE
ELLWOOD CITY, PA.

needed, etc. There is also information as to how to use this process for bulk plating of small parts in regular burnishing or tumbling equipment.

Water Filters

Micro Metallic Corp., Dept. MF, 30 Sea Cliff Ave., Glen Cove, N. Y.

Complete description of standard sizes of water filters, for use with filter-aid to handle 8 g.p.m. to 939 g.p.m., with typical flow sheet is contained in a new bulletin, No. 214.

Porous stainless steel filter medium has proved itself in many applications where corrosion resistance, high temperature and high pressure were important factors in the selection of the filter medium.

Polishing and Buffing Compounds

Russell H. Burns Compound Co., Dept. MF, 816 Lincoln Blvd., Middlesex, N. J.

A two-page data sheet lists compounds made by the company for precision finishing of metals, plastics, wood, celluloid, hard rubber, etc. These include polishing compounds for operations ranging from deburring and chamfering to fine finishing of chromium plate and cutlery. The sheet also describes company's line of buffing rouges for cut and color on jewelry, sterling or silver plate, precision steel dies, etc.

Cyclone Dust Collector

Hammond Machinery Builders, Inc., Dept. MF, Kalamazoo, Mich.

Bulletin 810 describes the company's line of Cyclone Duskolectors, including the various types available for use with polishing and buffing lathes, as well as miscellaneous applications.

Basic Alkali Chemicals

Diamond Alkali Co., Dept. MF, 300 Union Commerce Bldg., Cleveland 14, O.

Graphically depicting in word and picture its family of chemical products for industry and agriculture, the company has just published the fourth edition of "The Story of the Chemicals You Live By."

This newly revised and enlarged, 24-page booklet paints in broad strokes a panoramic picture of these basic materials, their principal applications and their production in a way that is interesting and informative to both technical and non-technical readers.

Products or product-groups discussed briefly are soda ash, caustic soda, chlorinated methanes, bicarbonate of soda, sodium silicates, calcium carbonates, chromates, specialized chemicals, organic chemicals, plastics and agricultural chemicals.

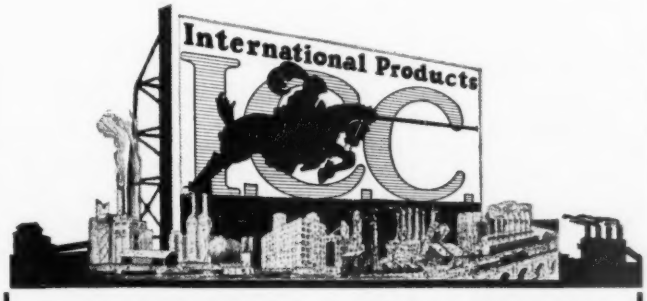
Pictorial supplements devoted to company plants on parade and a few random glimpses behind the scenes in making the company's products conclude the presentation.

Cooling Control

Sarco Company, Inc., Dept. MF, Empire State Bldg., New York 1, N. Y.

A new bulletin describes new self-powered T44 cooling control which holds temperature of cooling water in jackets or coils of equipment such as compressors, oil coolers, condensers and stills.

The unit costs less than $40.00. It is adjustable, ranges between 40-200°F. and is fully modulating. Single seated



INDUSTRIAL CLEANERS
FOR
ALL METALS
SOAK TANK • ELECTROPLATING • WASH TANK
VITREOUS ENAMELING • STRIPPING, ETC.
OIL AND WATER SOLUBLES
FOR
CUTTING • GRINDING • HONING • LAPPING
AND RUSTPROOFING
INTERNATIONAL
CHEMICAL COMPANY, INC.
2628 NO. MASCHER ST.
PHILADELPHIA 33, PA.

Pickling Pete
Knows his stuff
Picks Monel
Because it's tough!

Shop abuse doesn't faze Monel. It's tough and strong . . . good for years of pickling service in all common pickling acid solutions. For long-lived, lightweight equipment, look to Monel. Write for "5-Way Savings in Pickling."

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

extra life
extra capacity
extra safety
INCO
Monel Pickling Equipment

valve is suitable for use with water containing scale forming minerals.

The bulletin includes typical hook-up sketches. Write the company for Supplement 1 to Bulletin 700-A.

Cyanide Tester

Pollack Products Co., Dept. MF, 1628 E. 7th St., Brooklyn 30, N. Y.

New literature, describing the determination of free cyanide concentration of copper solutions by their quick "Test Pencil" method, is available from the above firm.

Handling Caustic Soda Safely

Diamond Alkali Co., Dept. MF, 300 Union Commerce Bldg., Cleveland 14, O.

A helpful, handy wall chart giving 37 specific, successful suggestions based on accumulated plant experience for safely handling solid, liquid and flake caustic soda has just been issued.

The wall chart, 17" x 23", is printed in two colors on coated linen stock tinned on top and bottom with metal eyelets for convenient hanging. It concisely presents safety recommendations covering first aid measures, protective practices and equipment, and dissolving and unloading procedures. Space is also provided for listing telephone numbers for emergency use.

Coloring Anodized Aluminum

Sandoz Chemical Works, Inc., Dept. MF, 61 Van Dam St., New York 13, N. Y.

The latest developments on coloring anodized aluminum have just been compiled and are now available in booklet form to the metal finishing industry and related trades.

This comprehensive booklet, offered as a service to the industry, refers to the following subjects: (1) Types of aluminum finishes possible and the versatility of anodizing methods. (2) Peculiarities of dyestuffs, their special properties and behavior patterns. (3) Choice of alloy in relation to the appearance of the finished product. (4) Surface preparation and the wide range of effects obtainable. (5) Anodizing conditions and their control for consistent results. (6) Sulfuric acid electrolyte and the specially selected dyes required. (8) Dyeing procedure and control methods with color chips of most-used colors.

Silicone Defoamers

Dow Corning Corp., Dept. MF, Midland, Mich.

Properties and performance of silicone defoamers are detailed in a new brochure just off the press. Special attention is given to Antifoam AF Emulsion, said to be the most efficient, versatile and easiest-to-disperse foam killer on the market. Its parent material, the original Antifoam A Compound, is also described. Suggested concentrations, dispersing media and application methods are discussed, along with actual working examples in fields ranging from food processing to metal-working. Four pages, illustrated.

Filter Plant Gauges

Simplex Valve & Meter Co., Dept. MF, 7 East Orange St., Lancaster, Pa.

Bulletin No. 1002 features the firm's new line of filter plant gauges. These

KARR MAIZE CELLULOSE

An Organic Grit and Meal

USED FOR:

Drying
Polishing
Burnishing
Filler
Carrier
Conditioner
Absorbent

Ingredient for Compounds
Polishing by airblasting
Cleaning by airblasting

Manufacturers

KARR & CO.

KARR-MAIZE DIV.

923 E. Broad St. Columbus 5, Ohio

SOMMERS BROS. MFG. CO.

MFRS. OF "BEACON"

Plating and Polishing Supplies and Equipment —Complete Semi and Full Automatic Installations—Gold, Silver and Chrome Rouge, Stainless Steel and Satin Finish Compounds—Buffs, Polishing and Felt Wheels.

3439 NO. BROADWAY
ST. LOUIS 7, MO.

TANK DOCTORS*

save you time and money! These durable solid plastic trouble shooting charts mounted right at your plating tanks will get you "off the hook" every time! Wonderful aid to continuous trouble free production. Only $3.50 each, prepaid. Available for chrome, copper, nickel. Joseph B. Kushner Electroplating School, 115 Broad St., Stroudsburg 1M, Pa.

*Copyrighted 1955

GUARANTEED BUFF CO., INC.

20 VANDAM STREET
NEW YORK 13, N. Y.

SERVING THE FINISHING INDUSTRY FOR
MORE THAN 50 YEARS
WITH A

Complete Line of Guaranteed, Quality

BUFFS & POLISHING WHEELS

INCLUDING PATENTED, VENTILATED & BIASED
STRAIGHT & 45° "SPOKE-BUFFS"

SOME SALES TERRITORIES AVAILABLE

Zialite

Reg. U. S. Pat. Off.

for NICKEL PLATING

The one bath especially designed for plating DIRECTLY on ZINC, LEAD, ALUMINUM, BRASS, COPPER and IRON.

for HARD CHROMIUM

USE Zialite ADDITION AGENTS

Harder deposits. Increased throwing power. Less sensitivity to sulfate content. Exceptionally fine results plating anything calling for Decorative or Hard Chrome.

ZIALITE CORPORATION

92 GROVE STREET WORCESTER 5, MASS.

units can be utilized for the measurement of effluent flow, loss of head, wash water, water elevation and per cent of filter bed expansion.

Throughout its 20 pages, the bulletin describes the various types of meters and includes facts on operation, construction, general information, sizes and capacities, specifications and other pertinent data of interest to consulting plant engineers, purchasing engineers and plant operating personnel.

Controlled Volume Pumps

Milton Roy Co., Dept. MF, Station E, 1300 East Mermaid Lane, Philadelphia 18, Pa.

Prepared with the assistance of leading water treating consulting firms, this new Bulletin 953 describes and illustrates how controlled volume pumps are used in typical industrial water treating systems.

Typical water treating processes described include coagulation systems, lime soda softening, hot process softeners, demineralization, and various types of boiler water treatment systems.

Thorough analysis is given to cooling tower water treating problems as well as methods and systems for waste and sanitary water treatment in this 24-page bulletin.

Pumping Heat Exchanger

Falls Industries, Inc., Dept. MF, 31781 Aurora Road, Solon, O.

The first catalog page on the Impervite "pumping-x-changer" has just been released. This latest development is designed to meet the growing need for a simplified, packaged, combination pumping and heat transfer unit for use in pilot plants, plating and pickling operations, and similar small batch processes.

NEW BOOK

Consulting Services

Published by Assoc. of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st St., New York 17, N. Y. 1955. Price: $1.00. 144 pages.

Table of Contents, Foreword and a page entitled "How To Find Your Consultant" precede three sections as follows:

Section I. *Classifier.* Immediately preceded by a numerical index for easy reference, this section contains over 200 items of activity, with the members specializing or qualifying in the given field indicated by key numbers, which correspond with the scope pages in Section II.

Section II. *Scope Pages. These* describe page by page each member's qualifications and activities.

Section III. *Index.* (a) Alphabetically by members, including names of organizations with which they are affiliated; (b) by geographical location, including branch offices, domestic as well as foreign, earmarked by an asterisk. Of great value to industry in foreign lands seeking the services of a specialized American consultant.

HAMILTON MILLS

INDIAN BRAND

TURKISH EMERY

For color and lustre beyond compare, specify INDIAN BRAND TURKISH EMERY. Preferred by those who know the best.

Also available — HECCO BRAND AMERICAN EMERY, for use in abrasive pastes and compositions.

HAMILTON EMERY & CORUNDUM CO.

CHESTER, MASS.

Truly—Three Great Finishes!!

CHROMIUM - UDYLITE

SHERARDIZING

For over a quarter of a century building and installing portable sherardizing furnaces and equipment: metal finishing and plating.

We invite your inquiry.

THE NATIONAL SHERARDIZING & MACHINE CO.

OFFICE & FACTORY: HARTFORD, CONN.

Foreign Representatives—

Oliver Bros., Inc., 417 Canal St., N. Y. City

"pH PAPERS"

Accurate ph Values in a few seconds right at the tank.

Indicator AND control-colors on SAME strip. Control-colors in steps of 0.2 pH and 0.3 pH.

Plating ranges
(200 strips of a range per box)

Acid:	Alkaline:
*4.8-6.2 pH	6.6- 8.0 pH
*3.6-5.0 pH	7.3- 8.7 pH
*2.4-3.9 pH	8.6-10.0 pH
1.0-2.8 pH	10.1-11.3 pH
0.4-1.4 pH	11.0-13.1 pH

*Electrometric Values in Nickel Solutions.

Each range is boxed separately.

PAUL FRANK

118 East 28th Street NEW YORK 16

Tel. MU 9-5286

IMPROVE YOUR PLATING

WITH PERIODIC-REVERSE UNITS

OF FINEST QUALITY

UPA

WRITE FOR INFORMATION

UNIT PROCESS ASSEMBLIES, INC.

VISIT BOOTH 347 CLEVELAND EXPOSITION

75 East Fourth Street New York 3, N. Y.

SELL IT THRU WAGNERS

WE WANT new products to sell. We want new ideas to develop for the national metal finishing market. Our active sales force is your assurance of volume. Our successful launching of new products such as anodes, automatics, filters, and rectifiers has given us the experienced background to market your line. Our technical staff will develop or service your product, our manufacturing facilities will produce it, and our sales organization will distribute it nationwide with profit and protection for you.

Phone, wire or write

JOE WAGNER

Wagner Bros., Inc.

Midland at Ross

Detroit 3, Mich

ADVERTISING RATES
Per column inch per insertion

1 time	$10.00
3 times	9.00
6 times	8.50
Yearly (12 times)	8.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

FOR SALE

PLATING MOTOR GENERATOR SETS (REBUILT) WITH COMPLETE PANEL EQUIPMENT — MOTORS — 3 PHASE, 60 CYCLE, 220/440 VOLT.

1—Hanson-Van Winkle-Munning 1000 ampere, 3-40 volt, interpole, 900 RPM. Exciter in head, Synchronous motor. Ser. #11152.

1—Chandeysson Electric 1000 ampere, 6 & 12 volt, Exciter in head, Synchronous motor.

1—Eager Electric 5000 ampere, 6 & 12 volt driven by 50 HP induction motor. Excited by "V" belt exciter.

1—Bennett & O'Connell 200 ampere 6 & 12 volt. 680 RPM, separately excited. Ser. #3926.

POLISHING LATHES — New & used — Constant & variable speed, single & double motor drives — 3 phase, 60 cycle, 220/440 volt. 1 to 20 HP in stock.

1—Hammond type J rotary Auto. 5 stations, 3 heads. Magnetic chucking.

1—Udylite rotary semi-auto. 6 stations, 4 heads. 66" table. Ea. head 7½ HP.

1—Production #101 tube polisher unit.

REBUILT RECTIFIERS — For Plating — 3 phase, 60 cycle, 220 volt.

2—400 amp. 0-6 volt Mallory-Udylite self contained.

6—500/6 volt Basic General Electric converted to selenium rectifiers.

10—Mallory Udylite 1500/6 & 12 with remote controls — Priced to sell.

MERCIL - CROWN - BAIRD - LASALCO - GLOBE BURNISHING & TUMBLING BARRELS

1—Crown Roto-Finisher barrel — dbl. compt. size of each compartment — 22" long x 36" deep.

1—Crown Oblique plating barrel unit — rubber lined.

NEW SELENIUM RECTIFIERS, complete with instruments, starter and built-in voltage regulation. All sizes from 50 amperes to 6000 amperes.

IMMEDIATE DELIVERY ON THE FOLLOWING SIZES — 3 phase, 60 cycle, 220 volt.

4000 ampere, 0-12 volt
2000 ampere, 3-6 volt OR 2000 ampere, 6-12 volt
1500 ampere, 3-6 volt OR 1500 ampere, 6-12 volt
1500 ampere, 0-12 volt
1500 ampere, 4-9 volt.

ALSO AVAILABLE — OTHER NEW AND REBUILT POLISHING LATHES, BARRELS, RHEOSTATS, RECTIFIERS, FILTERS, BLOWERS AND GENERATOR SETS. WE CARRY A COMPLETE LINE OF NEW AND REBUILT PLATING AND POLISHING EQUIPMENT AND SUPPLIES.

CLINTON SUPPLY COMPANY

112 South Clinton Street
Chicago 6, Illinois
FRanklin 2-3753

PLATERS AND ANODIZERS

M-G SETS — Motor 3-60-220/440

Amp.	Volt	Make
100	7½	Hobart
175	14	Delco
180	24/32	M. G. Corp.
200	7½	Chandeysson
300	7½	Hobart
400	60/60	G. E.
500	6	Chandeysson
500/250	6/12	Elec. Prod.
500/250	6/12	Optimus
635	55	Elec. Prod.
750/375	6/12	Excel
940	32	Elec. Prod.
1000/500	6/12	H-V-W
1500	13	Columbia
1500	30/50	Century
1500	40/65	G. E.
1500	70	Century
2000/1000	6/12	H-V-W
2000/1000	6/12	Chandeysson
2500/1250	6/12	Chandeysson
2500/1250	6/12	Elec. Prod.
3000/1500	6/12	Ideal
5000/2500	6/12	Eager
5000/2500	9/18	Chandeysson

BLOWERS & EXHAUSTERS

CFM	Pres.	Make
1100	4½" S.P.	Bayler
2344	2" S.P.	Clarage
2500	½" S.P.	American

MOTOR REPAIR & MANUFACTURING CO.
1555 HAMILTON AVE., CLEVELAND, OHIO

FOR SALE

New Polishing Material
And Equipment
WHEELS
BUFFS
GRAIN
BACKSTANDS
JACKS, ETC.

Due to discontinuing our Polishing Dept.
Priced right for immediate sale

NATIONAL ALUMINUM MFG. CO.
PEORIA, ILL.

FOR SALE

Available for Immediate Delivery

Steiner - Ives Electric Ovens, 12KW, Late Models 60" x 50" x 27" deep.
Industrial Washer and Dryer for small parts, 20 ft. long, 18" spiral cylinder, motor and pump.

5 HP Variable Speed L'Hommedieu Buffing Machines, 1¼" dia. shafts.

Chandeysson 1000 amp. 6 volt Motor Generator Set, and 2000 amp. 6 volt Hanson Van Winkle Munning Motor Generator Set, each with starting Equipment.

Hammond J-34 Rotary Polishing Machine with 3-#50 7½ HP Heads.

Hammond J-21 Rotary Polishing Machine with three 5 HP #50 Heads.

H & S
EQUIPMENT & SALES CO.

483 Keap St., Brooklyn, N. Y.
EVergreen 7-2526

IMMEDIATE SHIPMENT, ATTRACTIVE VALUES

THE FOLLOWING EXCELLENT REBUILT AND GUARANTEED ELECTROPLATING MOTOR GENERATOR SETS AND RECTIFIERS WITH FULL CONTROL EQUIPMENT:

— PLATERS —

1—7500/3750 Amp., 9/18 V., H-VW-M. Synch.
1—5000/2500 Amp., 7/14 V., Chandeysson, 25° C., Exc.-in-head.
1—5000/2500 Amp., 6/12 V., Chandeysson, 25° C., Synch., Exc.-in-head.
1—4000/2000 Amp., 6/12 V., Chandeysson, 25° C., Exc.-in-head.
1—3000/1500 Ampere, 6/12 Volt, Columbia, Synchronous.
1—2500/1250 Amp., 8/16 V., Electric Prod., Synch., Exc.-in-head.
1—2000/1000 Ampere, 9/18 Volt, Electric Products.
1—1500/750 Amp., 6/12 V., H-VW-M. Synch., Exc.-in-head.
1—1500/750 Amp., 12/24 V., Chandeysson, Synch., Exc-in-head.
1—1000/500 Amp., 6/12 V., Electric Prod.

— ANODIZERS —

1—4000 Amp., 40 V., Chandeysson, Exc.-in-head.
1—1000 Amp., 40 V., Chandeysson, 25°C.
1—1000 Amp., 30 V., Ideal, Exc.-in-head.
1—750 Amp., 60 V., H-VW-M. Synch., Exc.-in-head.
1—500 Amp., 25 V., Chandeysson, Synch., Exc.-in-head.
1—400 Amp., 40 V., M. G. C., Exc.-in-head.

— RECTIFIERS —

1—2000/1000 Amp., 6/12 V. G. E. Copper Oxide & Control.
1—Green Selectoplater, 1800 Amp., 12 V., 220/3/60.
1—Udylite-Mallory, 1500/750 Amp., 6/12 V., Control.

— SPECIAL —

1—20' x 4' x 3' H-VW-M Semi Automatic for Nickel.
1—Ransohoff Spiral Hot Air Dryer.
1—Crown 2-Compt. Horizontal Deburring Machine, each compt. 20" x 36". Unlined but can be lined.
1—Crown 1-Compt. Horizontal Deburring Machine, 60" x 36". Unlined but can be lined.
2—Crown Centrifugal Dryers, Size #1 and Size #2, Steam Heat.
1—Production Pipe Polishing Machine — Model 101, motorized.
2—Ronci Enamelers, No. R-100 and No. R-200.
1—K-4 Semi-Automatic Buffing Machine.
3—U. S. Elec. Tool, Model 110, Twin 15 HP Polishing Lathes.
1—Model "A" Pressure Blast.
1—Pressure Blast Jr. Model.

Above is partial list only. Write to us for all your requirements for Plating, Anodizing and Metal Finishing.

WIRE - PHONE - WRITE

M. E. BAKER COMPANY
25 WHEELER STREET, CAMBRIDGE 38, MASS.
Phone: Kirkland 7-5460

ADVERTISING RATES
Per column inch per insertion

1 time	$10.00
3 times	9.00
6 times	8.50
Yearly (12 times)	8.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

PRICED TO SELL!

MOTOR GENERATORS
RELIABLY REBUILT
1 YEAR GUARANTEE

6/12 VOLTS

1—10000 A HVW 2½/10 V.
1—10000 A J-L 2½/10 V.
1— 7500 A North. 2½/10 V.
1— 5000 A HVW 6/12 V.
1— 2500 A Chandey. 6/12 V.
1— 1500 A HVW 6/12 V.
1— 800 A HVW 6/12 V.
1— 600 A Eager 6/12 V.
1— 500 A Chandey. 12 V.
1— 300 A Hobart 6 V.
1— 200 A Boissier 6 V.
1— 200 A U. S. 12 V.
1— 150 A HVW 6 V.
3— 125 A Hobart 6 V.
1— 120 A Eager 7½/15 V.
1— 100 A HVW 6 V.

15 TO 28 VOLTS

1— 1000 A G.E. 15 V.
4— 25 A Diehl 25 V.
2— 100 A G.E. 28 V.
1— 200 A West. 28 V.
1— 500 A G.E. 28 V.
1— 800 A G.E. 28 V.
1— 1500 A Cent. 28 V.
1— 2500 A Cent. 28 V.

30 TO 60 VOLTS

1— 100 A G.E. 32 V.
1— 200 A West. 32 V.
1— 1000 A Cent. 32 V.
1— 1000 A Chandey. 40 V.
1— 1250 A Cent. 45 V.
1— 75 A G.E. 50 V.
1— 325 A West. 50 V.
1— 1500 A G.E. 50 V.
1— 1000 A G.E. 60 V.
1— 1000 A G.E. 75 V.

L. J. LAND, Inc.

146-148 GRAND STREET, NEW YORK 13, N. Y. CAnal 6-6976
ESTABLISHED 1910

PRICED RIGHT FOR QUICK SALE!

1—Chandeysson Motor Generator Set 1,000 Amperes 40 volts (excellent buy).
2—Daniels Plating Barrel #30LS with new lucite cylinders.
1—Chandeysson Motor Generator Set 6000/3000 Amperes 12/24 D.C. volts.
2—Industrial Filters suitable to both nickel and cyanide solutions.
1—Rectifier 1000/500 Amperes 9/18 D.C. volts complete with self contained control.
90—Steel, Rubber Lined, Lead Lined, Wood, Stainless Steel, etc. Plating, Dipping and Cleaning Tanks assorted sizes (write for particulars).
35—Tank Rheostats 25, 50, 100, 150, 200 Amperes etc. complete with voltmeters, ammeters, and shunts.
3—5 H.P. Bent Over Type Polishing Machines with motors v-belted to shafts.
3—Full Automatic Plating Machines.
2—Semi-Automatic Plating Machines.
1—Hammond Rotary Automatic Polishing Machine with 4-5 H.P. Heads.
1—Double 15 H.P. Gardner 5D Polishing Lathe w/2 - 15 H.P. B.B. motors and individual drives — heavy duty.

Rectifiers 25 amperes to 10,000 amperes — Tanks - all sizes and linings.
Compounds — Buffs — Chemicals — Anodes

BRUCAR EQUIPMENT & SUPPLY COMPANY

BOX 433 HEMPSTEAD, L. I., N. Y.
HYacinth 8-6122 or HYacinth 8-6195
WAREHOUSE — 604 - 20TH STREET, BROOKLYN, N. Y.

FOR SALE

•

Slightly Used
BUFFS

•

Loose and Sewed

•

Any Quantity

MICHIGAN BUFF CO., INC.
3503 GAYLORD AVENUE
DETROIT 12, MICHIGAN

Brand New Detrex Washers
ATTRACTIVELY PRICED

Single Stage Steam Heated Wire Mesh Belt Washer
Work opening 36" wide x 18" high. Approx. overall dimensions 10' L x 6'9" W x 6' H. FOB Pittsburgh, Pa.

Single Stage Steam Heated Gravity Roll Washer
—complete with exhaust system. Work opening 16" wide x 14" high. Approx. overall dimensions 9' L x 4' W x 7' H. FOB Detroit, Mich.

Single Stage Steam Heated Monorail Washer
Work opening 30" wide x 24" high. Approx. overall dimensions 10" L x 6'6" W x 6'6" H. FOB Detroit, Mich.

DETREX CORPORATION
Box 501 • Detroit 32, Michigan

SEMI-AUTOMATIC BUFFERS FOR SALE

3—Used Acme; type A-2. Immediate delivery from stock.

WOLCO EQUIPMENT COMPANY
326 E. 2nd St. Cincinnati 2, Ohio

RECONDITIONED EQUIPMENT

MACHINERY
1—101 Production Machine.
Udylite 40' full automatic cyanide plater 42" deep tanks.
Packermatic St. Line 45' Conv. comp. w-10 25 H.P. heads, all electrical equip. & controls.
2—Acme L-8-L 8 spindle rotary table, 3-polishing heads.
1—60" Packermatic Rotary Table 12 spindle.
1—484 Production duplex machine.
1—4 Spindle Semi-Automatic.
1—8 Spindle Semi-Automatic.
GENERATORS
1—Chandeysson 1000 amp. 40 volt Comp.
1—5000/2500 amperes 8/16 volts, Bogue.
POLISHING LATHES
2—Divine 5 H.P.
1—Double Divine 7½ H.P.
3—U. S. variable speed 5 H.P.
2—Gardner 5 H.P.
1—30 H.P. H.V.W.
FILTERS
1—Belke, rubber lined 750 G.P.H.
2—Industrial 14 x 36 cyanide filters.
PLATING BARRELS
1—Stevens Automatic 8 barrel (lined tanks).
TANKS
5—60"x36"x36" stainless steel, complete with overflows, ducts, and pipe connections.
2—Rubber Lined 8'x54"x48".
MISCELLANEOUS
1—7'x28"x48" steam degreaser with duct.
1—4' Circo S.S. Clad Electric Degreaser.
2—Ronci R-100 Lacquer Machines.
3—5 gal. Paint Pressure Tanks.
1—Divine Electric Glue Table w/6 pots.
1—Blakeslee Full Automatic Barrel Type Degreaser.

"IF IT'S METAL FINISHING EQUIPMENT OR SUPPLIES WE HAVE IT"

Pesco Plating Equipment Corp.
75 Wythe Ave., Brooklyn 11, New York
EVergreen 4-7472

EQUIPMENT FOR SALE

1 Motor Generator 1500/750 ampere 6/12 volt, made by Motor Generator Corp.

1 Rectifier 1500/750 ampere 6/12 volt, made by Udylite Corp.

2 Plating Barrels — Hanson-Van Winkle-Munning double 14 x 36 for alkaline plating baths.

All wired for 220/440 volts 3 phase 60 cycles.

CHAUTAUQUA PLATING CO., INC.
43 West Main St. Falconer, N. Y.

WANTED

Automatic polishing machine (Acme, Hammond, etc.). 30" table, 4 heads, 3-5 horsepower each, 12 or more spindles — indexing. Address: July 9, care Metal Finishing, 381 Broadway, Westwood, N. J.

SEND FOR OUR LIST OF BOOKS ON FINISHING

ADVERTISING RATES
Per column inch per insertion

1 time	$10.00
3 times	9.00
6 times	8.50
Yearly (12 times)	8.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

FOR SALE

COMPLETE — LIKE NEW —
IMMEDIATE DELIVERY

G. E. ROLLER HEARTH 850 KW — 1650 deg. F., 5' wide, 18" high, 35' long — 80' cooling.
G. E. ROLLER HEARTH 465 KW — 1650 deg. F., 5' wide, 18" high, 20' long — 40' cooling.
G. E. PUSHER 240 KW — 1650 deg. F., 5' wide, 24" high, 22' long — Quench Conveyor.
4000 CFH EXO GENERATOR with ecch above furnace.
YOUNG BROS. GAS RECIRC. CONVEYOR BELT — 1000 deg. F. 8' wide, 24" high, 45' long. NEW.
UDYLITE DIPPING MACHINE, 1-12 Station Rotary Type.
UDYLITE 1-14 Station Rotary Zinc Plating Unit.
DRYING SYSTEM OVEN 450 deg. F. — 13' W, 7' H, 64' L.
DRYING SYSTEM OVEN 150 deg. F. — 10' W, 9' H, 52' L.
500 CFH Westinghouse Endothermic Generator.
SURF. COMB. GAS BOX 30" W, 18" H, 36" L. 1800 deg. F.
MARSHALL BLOW PIPE VENT HOOD.

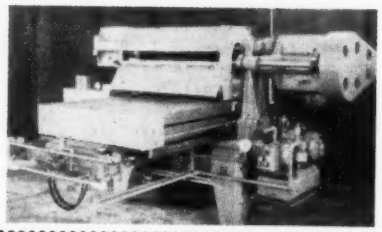
PAPESCH & KOLSTAD, INC.
10707 CAPITAL AVE.
OAK PARK (Detroit 37) Mich.
Lincoln 11100

SPECIAL SALE

CLAIR
SURFACE FINISHING MACHINE
WITH VACUUM TABLE
Model #203

- Only 20 hours use
- Perfect Condition

50% off original price



Call OR. 8-6281
INTERNATIONAL RECTIFIER CORPORATION
1521 E. Grand Ave.
El Segundo, Calif.

PLATING SHOP FOR SALE

Central part of Ohio. Modern, well equipped plating shop in city of 75,000 population. Asking $10,000. Will consider terms to reliable party. Due to other interests owner cannot devote sufficient time. Address: June 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

STRAIT LINE CONVEYOR FOR SALE

Demonstrator — 15' long with platens 15" wide x 6" long, with or without polishing heads. Address: June 18, care Metal Finishing, 381 Broadway, Westwood, N. J.

COMPLETE PLATING PLANT FOR SALE

MOSES GEORGE JEWELRY
711 West Third St.
Thibodaux, La.

ANODIZER FOR SALE

Generator 40 V 1500 Amp. connected to 100 HP motor.

FOX COMPANY
Cincinnati 23, Ohio

COMPLETE PLATING PLANT — JOB SHOP FOR SALE

Equipped with bright and bright copper solutions. Low rent. All the business you can handle, mainly auto replating. $8,000 gross monthly. Room to expand — large lot. Area pop. 300,000. Write:

STATEWIDE REAL ESTATE
1209 21st St. Sacramento, Calif.

SITUATIONS OPEN

BUFFING COMPOUND SALESMEN

SITUATION OPEN — Distributors, jobbers and manufacturers agents wanted to distribute and sell the full line of Schaffner's polishing and buffing composition in bar, spray or paste form, and a complete line of polishing room supplies.

SCHAFFNER MANUFACTURING COMPANY, INC.
Emsworth, Pittsburgh 2, Pa.

INDUSTRIAL SALES ENGINEERS

SITUATIONS OPEN — Previous or current sales experience in vapor degreasing equipment, alkali, washers, dryers, trichlorethylene and perchlorethylene required.

CIRCO EQUIPMENT COMPANY
Clark Township Rahway, N. J.

PROCESS ENGINEER

SITUATION OPEN — Live in Southern California, the land of progress and opportunity. Position open with Los Angeles manufacturer making the world's most complete and advanced line of barrel finishing equipment. Opening in barrel finishing processing and development department. Advancement opportunities for sharp, aggressive young man. Degree NOT necessary, but at least 4 years experience in barrel finishing procedures, media, compounds, etc. is required. Give full business and personal background and salary desired in first letter. Address: July 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

FOREMAN

SITUATION OPEN—Polishing and plating foreman wanted to supervise six experienced polishers and train new ones. Good pay and working conditions. Growing company — Cleveland area. Address: June 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES MANAGER

SITUATION OPEN — Manufacturer of buffing compounds has wonderful opportunity for right man to eventually become major principal in company. Must have broad selling experience in this field. Long established company. Excellent product reputation. Address: July 3, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES REPRESENTATIVE

SITUATION OPEN—Salesman wanted, thoroughly acquainted with plating industry, to sell copper core anodes. Excellent opportunity with one of country's leading anode manufacturers. Additional non-conflicting lines may be carried. Liberal compensation plan.

THE GILBERT TRAMER COMPANY
1217 Main Ave. Cleveland, Ohio

REPRESENTATIVES

SITUATIONS OPEN — Distributors, jobbers and manufacturers' agents wanted by a leading midwestern manufacturer to distribute and sell a complete line of polishing and buffing compounds in bar, spray or paste form. Several territories now open. Please give all particulars in first letter, which will be held in strict confidence.

McALEER MANUFACTURING CORP.
101 S. Waterman Ave. Detroit 17, Mich.

SALES REPRESENTATIVE

SITUATION OPEN—Eastern job plating shop wants man who is experienced in all phases of plating and metal finishing for quantity production. Address: July 4, care Metal Finishing, 381 Broadway, Westwood, N. J.

ADVERTISING RATES
Per column inch per insertion

1 time	$10.00
3 times	9.00
6 times	8.50
Yearly (12 times)	8.00

READY-REFERENCE SECTION
—USED EQUIPMENT AND SUPPLIES—

ELECTROPLATING
POLISHING
RUST PROOFING
CLEANING
ANODIC TREATMENT
ETC.

TECHNICAL SALES ENGINEER

SITUATION OPEN—Live in Southern California, the land of progress and opportunity. L. A. territory open for man capable of earning $10,000 to $15,000 year on salary, plus basis. Wonderful opportunity with manufacturer of the most complete and advanced line of barrel finishing equipment. At least 3 years of sales and engineering experience on barrel finishing and procedures is required. Give full business and personal background, salary desired in first letter. Address: July 2, care Metal Finishing, 381 Broadway, Westwood, N. J.

SALES REPRESENTATIVE

SITUATION OPEN—Salary plus commission incentive. Wanted by one of the leaders in the industrial chemical and finishing field and equipment manufacturing. We want an aggressive, self-starting, experienced man to call on industrial accounts in the Cleveland and Buffalo areas. Established accounts will be turned over to the right man. Write immediately giving full details of past experience, business and personal references and present salary level. Address: July 5, care Metal Finishing, 381 Broadway, Westwood, N. J.

PLANT MANAGER

SITUATION OPEN—Plant manager for well equipped plating plant in city of 50,000 population in Indiana. Manager will have complete charge, including sales and factory management. Excellent plant superintendent with 25 years experience now employed to handle production. Opportunity to become part owner. This is one of several plants owned and operated by young and aggressive organization. We want someone who is relatively young, ambitious and willing to work for what he wants. Full information available. Will stand thorough investigation. Address: May 1, care Metal Finishing, 381 Broadway, Westwood, N. J.

SITUATIONS WANTED

FOREMAN PLATER

SITUATION WANTED—Have ten years progressive job shop experience in various phases of plating, including anodizing. Conscientious and ambitious. Desire position with progressive company in Long Island, N. Y. Salary commensurate with ability. Address: July 6, care Metal Finishing, 381 Broadway, Westwood, N. J.

CHEMIST

SITUATION WANTED—34 years old, thoroughly experienced in all phases of electroplating and anodizing. Experience includes quality control, production control and personnel management. Address: July 7, care Metal Finishing, 381 Broadway, Westwood, N. J.

ELECTROPLATING SUPT.

SITUATION WANTED—Have 20 years experience in all phases of plating, analysis, maintenance and production; buffing and spray painting. Address: July 8, care Metal Finishing, 381 Broadway, Westwood, N. J.

CONTRACT FINISHING PLANTS

THE PRECIOUS METALS PLATERS

quality decorative and heavy electroplatings in
GOLD - SILVER - PALLADIUM - RHODIUM
for jewelry, industrial, electronic uses.
Palladium & Rhodium plated to 0.0005 in. thick.
Metallographically Controlled Electrodeposits.
THE PRECIOUS METALS PLATERS
P. O. Box 228 **Fairfield, Connecticut**

IF YOU ARE INTERESTED IN:

High vacuum evaporation of metals, etc. for industrial and commercial purposes — high vacuum metallurgy — ultrasonics applied to metal deposition — chemical reduction of metals — chemical, electrochemical etching or milling — electrochemical forming of metal products — electrochemical deposition of metals as: rare, precious, refractory; alloys; Mo, W, Zr, Ti, alloys — chemical, electrochemical coating and treatment of metals — Address: Special Processes, care Metal Finishing, 381 Broadway, Westwood, N. J.

Expert information for every designer, processor and user of electroplated parts!

ELECTROPLATING ENGINEERING HANDBOOK

by A. KENNETH GRAHAM
President of Graham, Crowley & Associates, Inc. in collaboration with over 40 widely-known authorities in the electroplating field.

1955, 660 pages, profusely illustrated, $10.00

Here's the complete, up-to-the-minute data book designed to answer every imaginable metal plating problem!

In nearly 700 pages jam-packed with tables, charts, plans and illustrations, this important new Handbook brings you all the most recent information available on processing techniques and the engineering factors involved in constructing and installing plating equipment. Full chapters cover the design of parts to be plated, standards and specifications, processing sequences, bath compositions, testing of deposits, waste treatment, manual and automatic plating machinery, rinsing and drying, maintenance, and every other engineering and operating consideration.

No matter what your interest in the electroplating field — engineer, designer, equipment manufacturer, shop superintendent, executive, or user of electroplated parts — you'll find just the information you're looking for every time you use this *complete* Handbook! Don't wait — order your personal copy *today*!

Send order with remittance directly to

METAL FINISHING, Book Dept, 381 BROADWAY WESTWOOD, NEW JERSEY

METALLIZING NON-CONDUCTORS

$2.00 PER COPY

BOOK ORDERS PAYABLE IN ADVANCE

FINISHING PUBLICATIONS, INC.

381 BROADWAY
WESTWOOD, N. J.

SUPPLIERS OF EQUIPMENT AND MATERIALS AND ADVERTISERS INDEX

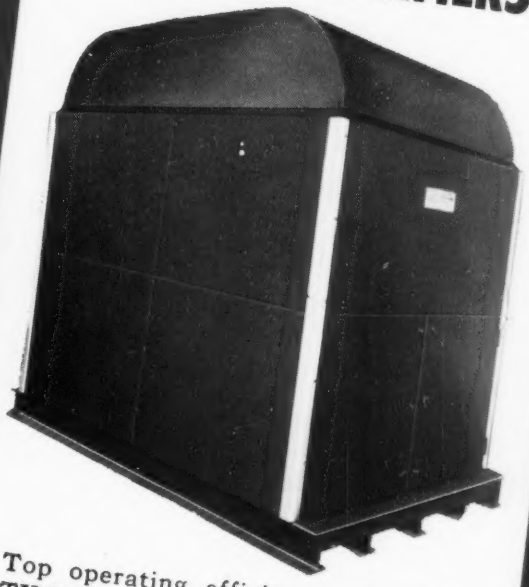
Acme Manufacturing Co. 14
1400 E. 9 Mile Rd., Detroit 20 (Ferndale), Mich.
Alert Supply Co. 96
4755 E. 49th St., Los Angeles 58, Calif.
Allied Research Products, Inc. 81
4004 E. Monument St., Baltimore 5, Md.
Almco Div., Queen Stove Wks.
Albert Lea, Minn.
Alsop Engineering Corp. 72
1005 Bright St., Milldale, Conn.
American Brass Co.
Waterbury 20, Conn.
American Buff Co. 38
2414 S. LaSalle St., Chicago 16, Ill.
American Platinum Works
231 New Jersey R. R. Ave., Newark 5, N. J.
A & P Finishing & Mfg. Co. 77
17760 Clarann Ave., Melvindale (Detroit), Mich.
Apothecaries Hall Co. 24
22 Benedict St., Waterbury 20, Conn.
Automotive Rubber Co.
12572 Beech Rd., Detroit 28, Mich.
Bacon Felt Co.
437 W. Water St., Taunton, Mass.
Baird Machine Co., The 6
Stratford, Conn.
Baker & Co., Inc. 30
113 Astor St., Newark 5, N. J.
Baker Co., The M. E. 102
25 Wheeler St., Cambridge, Mass.
Barker Bros., Inc. 85
1660 Summerfield St., Brooklyn 27, N. Y.
Bart-Messing Corp. Inside Back Cover
229 Main St., Belleville 9, N. J.
Beam Knodel Co. 91
195 Lafayette St., New York 12, N. Y.
Belke Manufacturing Co. 11, 91
947 N. Cicero Ave., Chicago 51, Ill.
Belmont Smelting & Refining Works, Inc.
304 Belmont Ave., Brooklyn 7, N. Y.
Better Finishes & Coatings, Inc. 82
268 Doremus Ave., Newark 5, N. J.
Blakeslee & Co., G. S. 7
Chicago 50, Ill.
Block & Co., Wesley
39-15 Main St., Flushing, N. Y.
Brucar Equipment & Supply Co. 103
Box 433, Hempstead, L. I., N. Y.
Buckeye Products Co.
7033 Vine St., Cincinnati 16, Ohio
California Rack Co. 96
4982 Firestone Blvd., South Gate, Calif.
Central Machine Works
72 Commercial St., Worcester, Mass.
Chandeysson Electric Co. 25
4074 Bingham Ave., St. Louis 16, Mo.
Chemical Corp., The 41
54 Waltham Ave., Springfield, Mass.
Circo Equipment Co.
130 Central Ave., Clark Twp. (Rahway), N. J.
Clair Manufacturing Co.
Olean, N. Y.
Cleveland Process Co. 34
1965 East 57th St., Cleveland 3, Ohio
Clinton Supply Co. 102
112 S. Clinton St., Chicago 6, Ill.
Codman Co., F. L. & J. C.
694 Plain St., Rockland, Mass.
Cowles Chemical Co.
7016 Euclid Ave., Cleveland 3, Ohio
Crown Rheostat & Supply Co. 27
3465 N. Kimball Ave., Chicago 18, Ill.
Davies Supply & Mfg. Co.
4160 Meramec St., St. Louis 16, Mo.
Davis-K Products Co. 34
135 W. 29 St., New York, N. Y.
Deming Co., The
567 Broadway, Salem, Ohio
Diamond Alkali Co.
300 Union Commerce Bldg., Cleveland 14, Ohio
Dixon Rippel, Inc.
Kingston, N. Y.
Dow Chemical Company, The
Midland, Michigan
Du-Lite Chemical Corp.
Middletown, Conn.
Du Pont de Nemours & Co., E. I.
Wilmington, Del.
Electro-Glo Co.
1430 S. Talman Ave., Chicago 8, Ill.
Electronic Rectifiers, Inc. 90
2102 Spann Ave., Indianapolis 3, Ind.
Enthone, Inc. 3
442 Elm St., New Haven, Conn.
Exolon Co.
945 E. Niagara, Tonawanda, N. Y.
Federated Metals Div., American Smelting & Refining Co. 78
120 Broadway, N. Y. 5, N. Y.
Formax Manufacturing Co.
3171 Bellevue, Detroit 7, Mich.
Frank, Paul 101
118 E. 28th St., New York 16, N. Y.
General Electric Co. 16, 17
Schenectady 5, N. Y.
Glo-Quartz Electric Heater Co., Inc. 26
37934 Elm St., Willoughby, Ohio
Graver Water Conditioning Co.
216 W. 14th St., New York 11, N. Y.
Guaranteed Buff Co., Inc. 100
20 Vandam St., New York 13, N. Y.
Gumm Chemical Co., Inc., Frederick Inside Front Cover, 8
538-542 Forest St., Kearny, N. J.
H & S Equipment & Sales 102
483 Keap St., Brooklyn 11, N. Y.
Hamilton Emery & Corundum Co. 101
Chester, Mass.
Hammond Machinery Builders, Inc. 75
1601 Douglas Ave., Kalamazoo 54, Mich.
Handy & Harman
82 Fulton St., New York 38, N. Y.
Hanson-Van Winkle-Munning Co. 42, 74A-D
Matawan, N. J.
Harrison & Co., Inc. 90
487 Groveland St., Haverhill, Mass.
Harshaw Chemical Co., The 21
1945 E. 97th St., Cleveland 6, Ohio
Hartford Steel Ball Co., The 92
Hartford 6, Conn.
Haveg Corp.
Newark 5, Del.
Henderson Bros. Co.
133 S. Leonard St., Waterbury, Conn.
Holland & Sons, Inc., J. 89
475 Keap St., Brooklyn 11, N. Y.
Hull & Co., R. O.
1303 Parsons Ct., Rocky River 16, Ohio
Hussey & Co., C. G.
2860 Second Ave., Pittsburgh 19, Pa.
Illinois Water Treatment Co. 28
836 Cedar St., Rockford, Ill.
Industrial Filter & Pump Mfg. Co. 15
5906 Ogden Ave., Chicago 50, Ill.
Industrial Instruments, Inc.
89 Commerce Rd., Cedar Grove, N. J.
Infilco, Inc. 32
912 S. Campbell Ave., Tucson, Ariz.
International Chemical Co., Inc. 99
2628 N. Mascher St., Philadelphia 33, Pa.
International Nickel Company, Inc. 99
67 Wall St., New York 5, N. Y.
International Rectifier Corp.
1521 E. Grand Ave., El Segundo, Calif.
International Rustproof Corp. 96
12507 Plover Ave., Cleveland 7, Ohio
Jelco Products
153 E. 26th St., New York 10, N. Y.
Joe-D Buff Co. 28
Sandwich, Ill.
Karr-Maize Div., Karr & Co. 100
923 E. Broad St., Columbus 5, Ohio
Kaykor Industries
4400 Broad St., Yardville, N. J.
Kocour Company 92
4802 S. St. Louis Ave., Chicago 32, Ill.
Kosmos Electro-Finishing Research
13 Valley St., Belleville 9, N. J.
Kushner, Joseph B. 100
Stroudsburg, Pa.
Lancy Laboratory 98
533 Wampum Ave., Elwood City, Pa.
Land, Inc., L. J. 103
146-148 Grand St., New York 13, N. Y.
Lasalco, Inc. 29
2818-38 Lasalle St., St. Louis 4, Mo.
Lea Mfg. Co. 66A
16 Cherry Ave., Waterbury 86, Conn.
Lea-Michigan, Inc.
14066 Stansbury Ave., Detroit 27, Mich.
Lea-Ronal, Inc. 66B
237 E. Aurora St., Waterbury 20, Conn.
L'Hommedieu & Sons Co., Chas. F. 5
4521 Ogden Ave., Chicago, Ill.
Macarr, Inc.
2458-60 Arthur Ave ,.Bronx 58, N. Y.
MacDermid, Incorporated Back Cover
Waterbury 20, Conn.
Magnus Chemical Co.
11 South Ave., Garwood, N. J.
Magnuson Products, Inc.
50 Court St., Brooklyn 1, N. Y.
Matheu Tool Works
2426B N. Clybourn, Chicago 14, Ill.
McGean Chemical Co. 13
1040 Midland Bldg., Cleveland 15, Ohio
Meaker Co., The
1635 So. 55th Ave., Chicago 50, Ill.
Metal Finishing Mfg. Corp.
89 N. 11th St., Brooklyn 11, N. Y.
Michigan Buff Co. 103
3503 Gaylord Ave., Detroit 12, Mich.
Michigan Chrome & Chemical Co.
8615 Grinnell Ave., Detroit 13, Mich.
Mido Products 97
1801 Border Ave., Torrance, Calif.
Minnesota Mining & Mfg. Co. 33
900 Fauquier Ave., St. Paul 6, Minn.
Mitchell Bradford Chemical Co.
Wampus Lane, Milford, Conn.
Motor Repair & Mfg. Co., The 102
1555 Hamilton Ave., Cleveland 14, Ohio
Munning & Munning, Inc. 36
202-208 Emmet St., Newark, N. J.
Murray-Way Corp. 20
P. O. Box 180, Maple Rd. E., Birmingham, Mich.
Mutual Chemical Div., Allied Chemical & Dye Corp. 10
99 Park Ave., New York 16, N. Y.
National Aluminate Corp.
6297 W. 66th Place, Chicago 38, Ill.
National Research Corp. 39
Charlemont St., Newton Highlands 61, Mass.
National Sherardizing & Machine Co., Inc. 101
Hartford, Conn.
Niagara Alkali Co. 34B
60 E. 42nd St., New York 17, N. Y.
Nobles Engineering & Mfg. Co.
647 East 7th St., St. Paul, Minn.
Northwest Chemical Co. 22
9310 Roselawn Ave., Detroit 4, Mich.
Norton Co.
1 New Bond St., Worcester 6, Mass.
Oakite Products, Inc. 4
18 Rector St., New York 6, N. Y.
Packer Machine Co. 12
Center St., Meriden, Conn.
Pennsylvania Salt Mfg. Co.
3 Penn Center Plaza, Philadelphia 2, Pa.
Perma-Line Rubber Products Corp.
1755 N. Winnebago Ave., Chicago 47, Ill.
Permutit Co.
330 W. 42nd St., New York 36, N. Y.
Pesco Plating Equipment Corp. 103
75 Wythe Ave., Brooklyn 11, N. Y.
Platers Research Corp. 89
59 E. 4th St., New York 3, N. Y.
Powers Regulator Co., The 79
3400 Oakton St., Skokie, Ill.
Promat Div., Poor & Co.
851 S. Market St., Waukegan, Ill.
Pyrosil, Inc. 94
Cuyahoga Falls, Ohio
R. C. H. Supply Co.
7031-33 Santa Fe Ave., Huntington Park, Calif.
Ramco Equipment Corp., Div. of Randall Mfg. Co., Inc.
1373 Lafayette Ave., New York 59, N. Y.
Rampe Manufacturing Co.
14915 Woodworth Ave., Cleveland 10, Ohio
Ransohoff, Inc.
630 N. Fifth St., Hamilton, Ohio
Rapid Electric Co. 9
2881 Middletown Road, Bronx 61, N. Y.
Richardson Allen Corp.
39-15 Main St., Flushing, N. Y.
Roto Finish Co.
3706 Milham Rd., Kalamazoo, Mich.
Rutley Industries, Inc. 37
415 Greenwich St., New York 13, N. Y.
Saran Lined Pipe Co. 23
2415 Burdette Ave., Ferndale 20, Mich.
Sarco Co., Inc.
350 Fifth Ave., New York 1, N. Y.
Schaffner Mfg. Co. 93
Schaffner Center, Emsworth, Pittsburgh 2, Pa.
Schori Process Div., FerroCo Corp. 30
8-11 43rd Road, Long Island City 1, N. Y.
Sel Rex Precious Metals, Inc. 73
229 Main St., Belleville 9, N. J.
Sethco Mfg. Co. 95
78 Willoughby St., Brooklyn, N. Y.
Seymour Mfg. Co.
15 Franklin St., Seymour, Conn.
Siefen Co., J. J. 88
5643 Lauderdale, Detroit 9, Mich.
Simonds Abrasive Co.
Philadelphia 37, Penna.
Smoothex, Inc.
10705 Briggs Rd., Cleveland 11, Ohio
Solvay Process Div., Allied Chemical and Dye Corp.
61 Broadway, New York 6, N. Y.
Sommers Bros. Mfg. Co. 100
3439 No. Broadway, St. Louis 7, Mo.
Sparkler Mfg. Co. 35
Mundelein, Ill.
Standard Plating Rack Co.
1925 N. Paulina St., Chicago 22, Ill.
Starline Products
1717 N. Main St., Los Angeles, Calif.
Stevens, Inc., Frederic B. 70, 71
Detroit 16, Mich.
Stokes Machine Co., F. J.
5500 Tabor Rd., Philadelphia 20, Pa.
Storts Welding Co., Inc. 88
38 Stone St., Meriden, Conn.
Stutz Mfg. Co., Geo. A.
4430 Carroll Ave., Chicago 24, Ill.
Sulphur Products Co., Inc. 94
Greensburg 7, Pa.
Swift Industrial Chemical Co.
Canton, Conn.
Tamms Industries, Inc. 95
228 N. LaSalle St., Chicago 1, Ill.
Technic, Inc. 83
39 Snow St., Providence, R. I.
Ther Electric & Machine Wks.
19 S. Jefferson St., Chicago 6, Ill.
Thermex Co., Inc., N. J. 84
535 Bergen St., Harrison, N. J.
Thermo-Panel Div., Dean Products, Inc. 97
1042 Dean St., Brooklyn 38, N. Y.
True-Brite Chemical Products 98
P. O. Box 31, Oakville, Conn.
Udylite Corp., The 18, 19
Detroit 11, Mich.
Unit Process Assemblies, Inc. 101
75 East 4th St., New York, N. Y.
United Chromium, Inc. 34A, 87
100 East 42nd St., New York 17 ,N .Y.
U. S. Galvanizing & Plating Equipment Corp. 40
31 Hayward St., Brooklyn, N. Y.
U. S. Stoneware Co.
Akron 9, Ohio
Van Dorn Iron Works Co.
20 E. 79th St., Cleveland 4, Ohio
Vanton Pump & Equipment Corp.
201 Sweetland Ave., Hillside, N. J.
Wagner Bros., Inc. 101
418 Midland, Detroit 3, Mich.
Wallace & Tiernan Co., Inc.
25 Main St., Belleville 9, N. J.
Westinghouse Electric Corp.
P. O. Box 868, Pittsburgh 30, Pa.
Worklon, Inc.
253 W. 28th St., New York 1, N. Y.
Wyandotte Chemicals Corp. 31
Wyandotte, Mich.
Zialite Corp. 100
92 Grove St., Worcester 5, Mass.

Sel-Rex PLATING EQUIPMENT

"PLATEMATES"

Sel-Rex PLATING RECTIFIERS

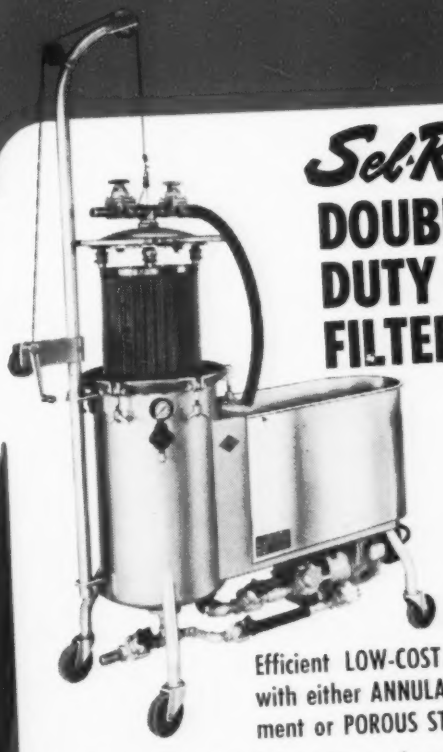
Time-tested dependable
Completely sealed



Top operating efficiency AT ALL TIMES because they cannot corrode... require no maintenance...never need cleaning. The cabinet is gasketed and sealed to withstand highly corrosive atmospheres. Air within the cabinet is cooled by an air-to-water heat exchanger.

There is a Sel-Rex Rectifier for every type Power requirement. A staff of well-trained personnel is provided to assist you in conducting an economical and highly efficient plating operation.

Sel-Rex DOUBLE DUTY FILTERS



Efficient LOW-COST operation with either ANNULAR bag element or POROUS STONE.

Cuts filter cleaning time to less than 15 minutes! Can be operated *by anyone immediately*. The entire Annular element is secured to the tank cover—lifts out freely and easily for cleaning, either by hand or with the sturdy, hand-operated davit mounted on the tank of larger units. Messy handling of wet and dirty elements is eliminated — you can even clean an element used for carbon treatment without soiling your hands!

The compact design saves valuable shop space—the new Annular element gives DOUBLE the amount of filtration area and speed in the same space required by other filters. Standard models from 250-18,000 GPH capacity.

Larger models built to specifications.

Write for complete literature

NEMA

BART-MESSING CORPORATION

[illegible] MAIN STREET • BELLEVILLE 9, N. J.

Manufacturers and Distributors of Plating and Polishing Equipment and Supplies.

Have You Tried These Products for Finishing Aluminum?

ALUMETEX PROCESS for Plating on Aluminum

Complete process — one cycle for all commonly used alloys — cleaning — acid etching — zincating — and plating. Place the complete cycle in our hands and assure yourself of lustrous, blister-free, corrosion-resistant plated coatings. Write for Data Sheet No. 13 for complete instructions for plating on aluminum — still tanks — barrel — or full automatic plating.

MAC DERMID Aluminum Bright Dip #2

An improved acidic formula used as received for producing brilliant finishes on all non silicon aluminum alloys. Operates at temperature of 170°F to 200°F. Immersion times of 30 seconds to 1½ minutes are normal for most alloys. Work chemically dipped in MacDermid Aluminum Bright Dip is in excellent condition for anodizing — coloring — plating — or as a final finish. Articles can be dipped in bulk or on racks — automatically or by hand. Write for Data Sheet No. 21.

CLEANERS for ALUMINUM

A complete range of alkaline and emulsion cleaners from heavy etch to mild buffing compound removal types are available. Metex #2 heavy etch, Metex #4 mild non etch, Metex TS-40A for buffing compound removal, Metex D Special for non tarnish spray applications. Write for Data Sheet No. 24.

SPECIALTIES for Finishing Aluminum

MacDermid Incorporated has produced many specialty items for a wide range of applications. If you have a problem, write for the name of technical representative nearest you. Anodizing strippers, Etch salts for obtaining uniform dye colors on silicon alloys, Process for producing frosted finish on all alloys, Strippers for paint and plate removal, Burnishing compounds, Deoxidizers for cleaning prior to spot welding, Phosphate finishes — Write for Data Sheet No. 24.

MAC DERMID
★ *Incorporated* ★
WATERBURY 20, CONNECTICUT

Write For Free Data Sheets

FOR 33 YEARS *Originators* FOR THE METAL FINISHING INDUSTRY